

The Chemical Age, April 22nd, 1944.

LABORATORY FURNISHING AND SCIENTIFIC INSTRUMENT NUMBER

The Chemical Age

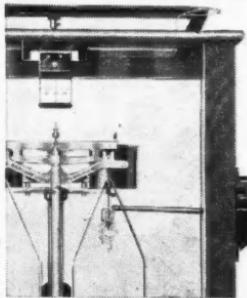
A Weekly Journal Devoted to Industrial and Engineering Chemistry

VOL. L
NO. 1295

SATURDAY, APRIL 22, 1944
REGISTERED AS A NEWSPAPER

MAY 2, 1944

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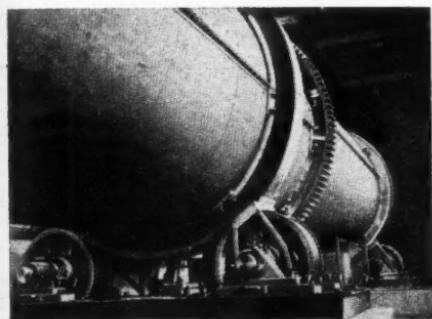
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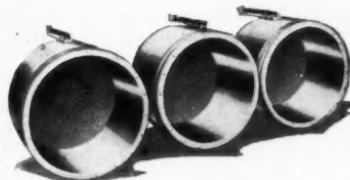
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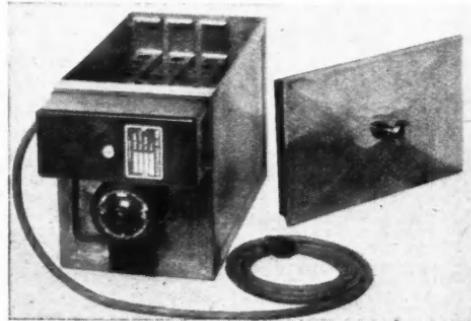
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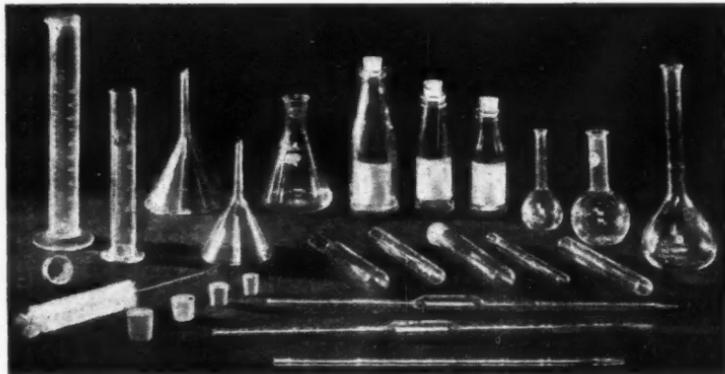
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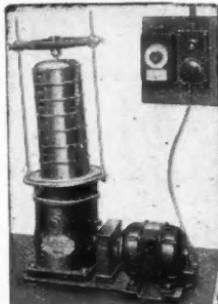
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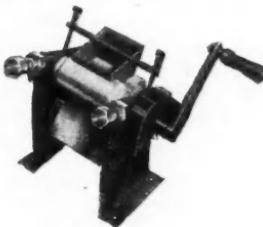
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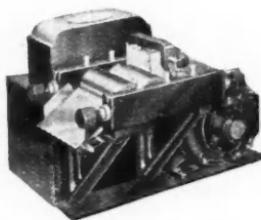
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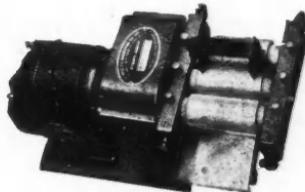


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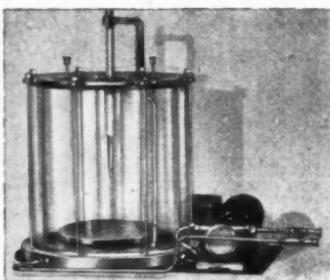
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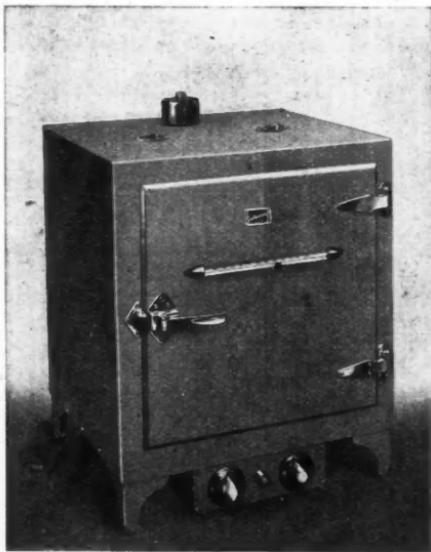
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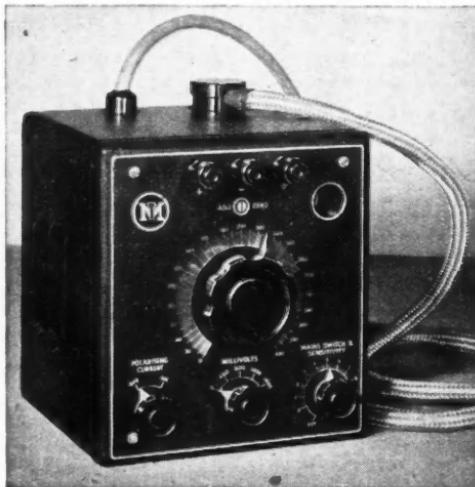
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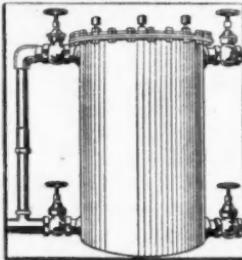
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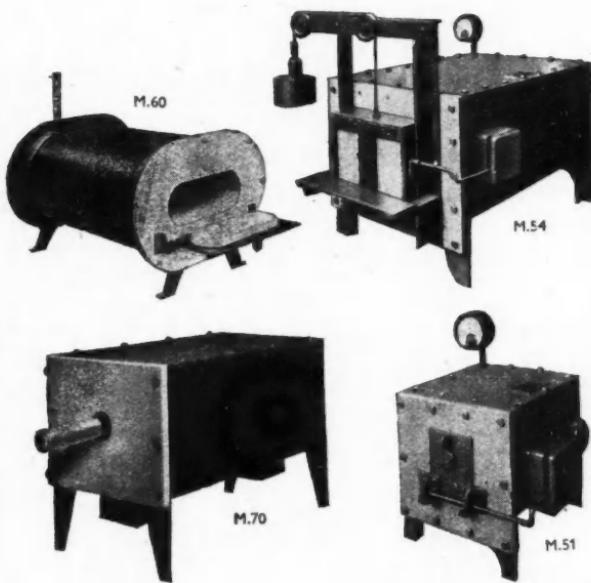
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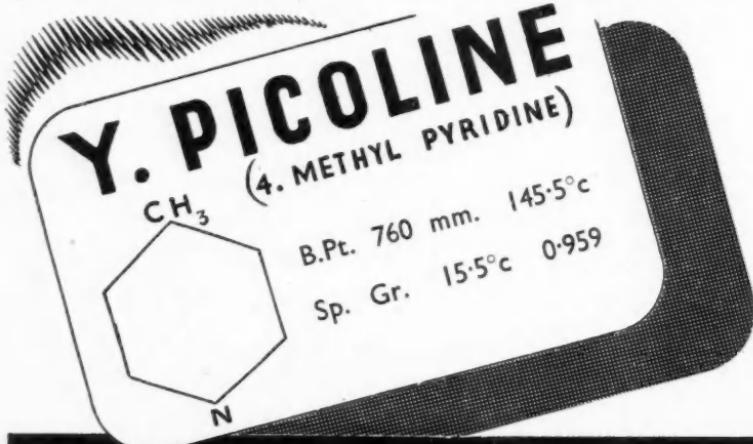
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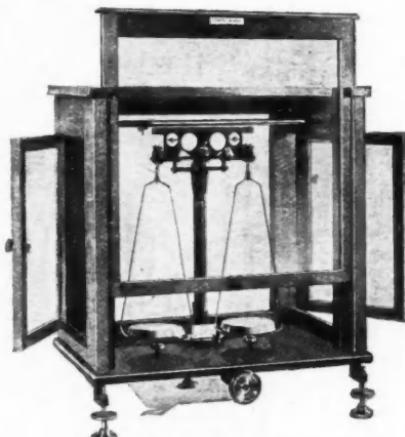
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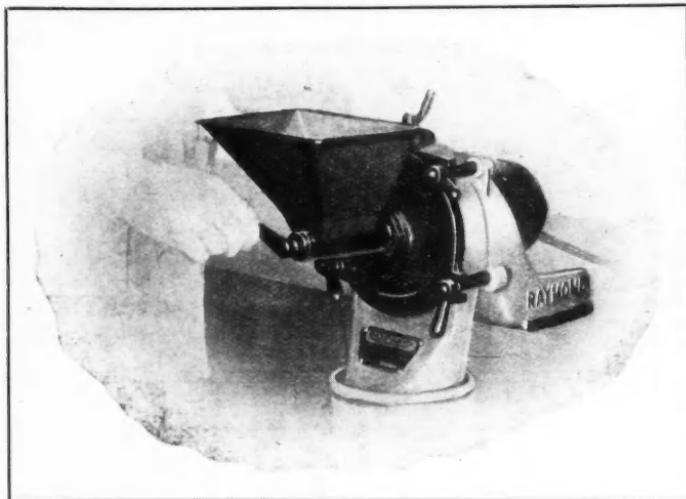
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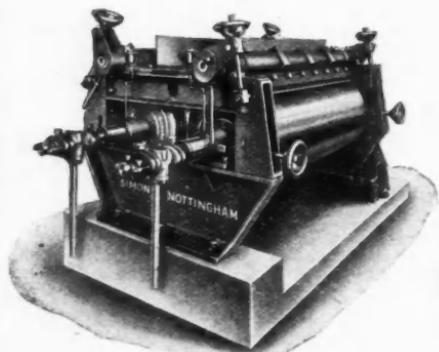
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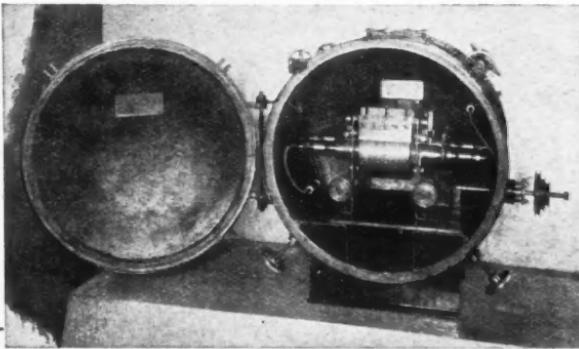
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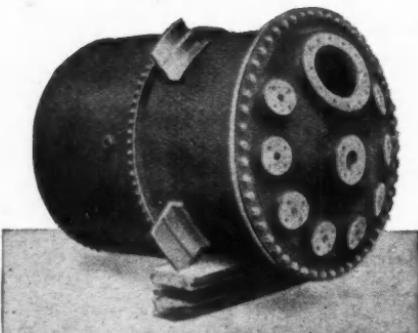
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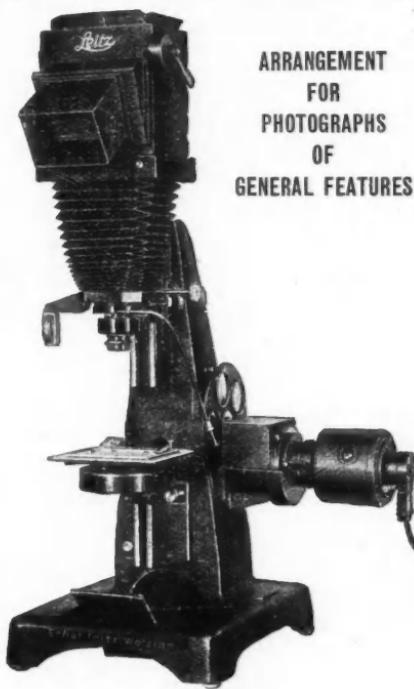
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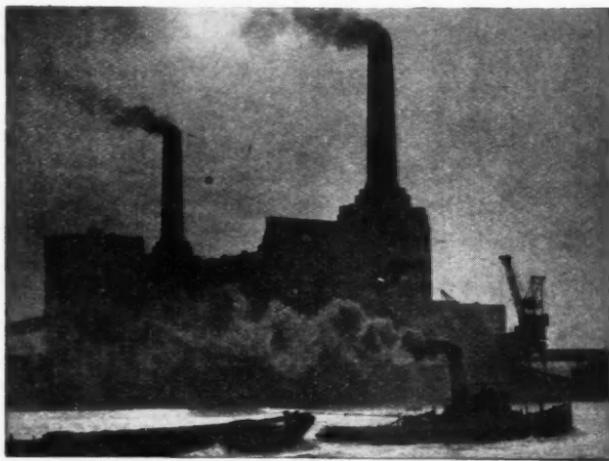
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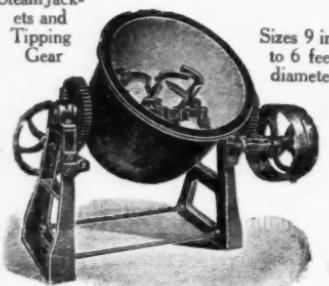
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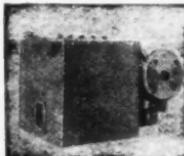
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The Encouragement of Invention

TWO pronouncements that have lately been made by men of experience in industry and industrial research are deserving of special attention. Lord Riverdale and Dr. W. H. Eccles, F.R.S., have both expressed in no uncertain terms the opinion that the application of discoveries in Great Britain lags far behind the scientific research from which they spring. Both agree that British science and invention are not one whit behind those of other nations, but that we lose our initial advantage by failing to apply the discoveries in a practical manner. The record of the scientists of this country in respect of war inventions has been second to none; no sooner has the enemy invented a "secret weapon" with which he has declared his intention of casting us down, than the scientists have invented a counter-weapon that has brought it to nought, and have gone one better themselves. These war inventions are neither scientific toys nor laboratory curiosities; they have been applied in practice, thus showing that there is no inherent congenital inability on the part of the British to apply scientific discovery to practical ends. It is just that by and large we do not do it in

normal times to the same extent as other nations. Why is this?

There are many reasons. The usual explanations are that our business men lack scientific or technical background and training and that our scientific men have no practical touch. There is a division into two worlds, and "never the twain shall meet." Dr. Eccles believes that social prejudice has something to do with this. "I have often sensed," he says, "a feeling among the middle, or comfortable, class that the boy who enters industrial science thereby suffers a loss of caste. Industrial science in England has probably lost many bright ingenious minds because of this social prejudice." It is undeniable that if the directorate of a firm is not well-disposed towards the application of science to

their business, science will be cast out. This does not arise from prejudice; it is part of our business system whereby we give our highest posts to accountants, solicitors, financiers, politicians, "business men" (whatever that may mean), and so forth, leaving the technical man and the scientist in the outer office. Everybody knows enough about finance to misunderstand the subject, and it is a fact that the practical development of sci-

On Other Pages

Letters to the Editor	372
The "Master Key" Industries	373
Fluorspar Meeting	376
Development in Laboratory Apparatus	377
Institution of Chemical Engineers	380
On Precision Viscometry	385
Speed of Chemical Reactions	389
Temperature Measurement and Control	390
Towers Streamline Hydrometers	391
On the Food Front	392
A New Hygrometer	392
A Useful Portable Furnace	393
Glass-Lined Equipment	394
Trend of War-Time Earnings	395
A Chemist's Bookshelf	396
Personal Notes	397
New Control Orders	397
General News from Week to Week	398
Stocks and Shares	401
British Chemical Prices	402

tific discovery is an expensive matter. When it comes to a decision whether to spend money or not, the likelihood of financial returns weighs heavily with people of this type of background. Even in the chemical and chemical-plant industry there is found a lack of perspective, a curious belief that development work is a highly speculative investment.

This brings us to the fundamental difficulty in developing scientific research. Lacking the perception that there is a positive value even in unsuccessful research (where the word "research" is used to denote its application also), the average business man takes the view that it is better to pay the foreigner to do his research for him. The view has been put forward quite seriously that if we allow the Germans, for example, to spend their money and time in developing a new process, and then buy the finished and perfected article from them, we have done a highly profitable stroke of business. We have got, without any effort on our part, the most up-to-date plant and process, and someone else has taken all the risk. A junior offshoot from this attitude is the request, when any new plant is proposed to a buyer, "Where can I see one in operation?" This attitude cannot be too strongly condemned. It has given other nations, and above all the Germans, the monopoly of certain types of plant manufacture, including chemical plant; it has enabled those other nations to acquire an undeserved reputation for scientific and technical brilliance to which they are not entitled by comparison with ourselves, as our war record has shown once again. It has consequently sent foreign buyers to other markets and lost much of the trade which our financial rulers seek.

There is no longer any possible doubt that this country must live by its own efforts after this war is over, just as it survived by its own efforts during the years when we fought completely or virtually alone. We have already seen evidence of the old spirit in the inclination of representatives of certain British firms to meander in the direction of the U.S.A. in order to obtain patent rights for processes developed there in preference to developing them ourselves. We are once more thinking of standing on someone else's feet and not on our own. It is a British characteristic, which other

nations jibe at now and again, to expect someone else to do our work for us. Only when we are driven with our backs to the wall and there is no one behind us, do we buckle to and show what we can do. In this particular case of the industrial development of scientific discovery we must abandon our traditional attitude and help ourselves. We must rely, as Lord Riverdale has said, on the ingenuity and enterprise of the manufacturers: "Scientific and industrial research can help enormously both to improve our products and to expand export trade, but it is absolutely necessary to have faith that money spent in this way pays." War brings with it an increased rate of industrial development. Why? Is it not partly because our scientific workers are driven to seek a practical outlet for their activities? And, perhaps an even greater reason, because the money required for the industrial development of scientific discovery is freely forthcoming. Why cannot we as a nation continue, in time of peace, the war rate of development? If we can organise for peace we can organise for war.

The first essential is to convince the Government of the necessity for this step. The Government is doing more than anyone else to prevent our post-war industrial recovery, through its financial policy. The Treasury, the buying departments of the Services (acting on Treasury instructions), and the Select Committee on National Expenditure, all seem imbued with the accountancy spirit. There must be only a small return on capital on war orders; if there is the slightest loophole, a return of legitimate profits is demanded or requested. This is utterly and completely wrong. If our firms are not allowed now to amass financial resources, they cannot effect the change-over of plant and processes, the rehabilitation of equipment, the development of new processes, that are so necessary to our industrial success. There will be no money left to pay for Beveridge schemes and other social amenities unless industry earns it. One of the principal ways in which industry can do this—perhaps in the long run the only one—is by keeping well ahead of most of the rest of the world in the development of new processes and new ideas. We must stand quite firmly on our own feet.

NOTES AND COMMENTS

Controlling German Chemistry

LORD CHERWELL'S official statement in the House of Lords on Tuesday, in which he announced the Government's intentions regarding the control of German industry after the war with a view to obviating the repetition of the current tragedy, may well revolutionise the whole history of the chemical industry. We believe it was Sir Robert Robinson who first suggested the prohibition or rigid control of the manufacture of nitrogen in Germany, and this suggestion has had widespread repercussions. It has been criticised, both favourably and adversely, in the technical press of this country and the United States, and various amplifications and emendations of it have been mooted. The Government's proposals, as stated by Lord Cherwell, go further than anything so far suggested. While putting nitrates near the top of the list, he quoted rubber, alloys, nickel, and copper as other materials the prohibition of whose preparation might be extremely effective in reducing Germany's future war potential. The Government was not unmindful of the fact that nitrates were used in the manufacture of fertilisers, that Germany depended on these fertilisers, and that her neighbours depended on food supplies from Germany. Nevertheless, he asserted categorically that the Government would take every step possible, *however inconvenient it might be*, to prevent a recurrence of the disaster of war. It is evident that the chemical tools for the building up of a war potential are not again to be allowed, in our time, to "this strange and formidable compound of docility and ferocity which makes up the German mentality."

The Road to Serfdom

HIgh priority, to borrow a phrase from the world to which Professor Hayek objects, should be given to his latest work *The Road to Serfdom* (Routledge, 10s. 6d.). This is a short book on a big subject; a learned book for the lay reader; an opportune dissertation on the underlying problems of our time. It has come as refreshment to those who, struggling with detailed arguments about control, security, or planning, are

very liable to become befogged on the main issue. Professor Hayek dedicates *The Road to Serfdom* to the Socialists of all parties, and shows that "the general endeavour to achieve security by restrictive measures, tolerated or supported by the State, has in the course of time produced a progressive transformation of society—a transformation in which, as in so many other ways, Germany has led and the other countries have followed." Defining freedom as the range of choice, the author lays it down "that the system of private property is the most important guarantee of freedom, not only for those who own property, but scarcely less for those who do not. It is only because the control of the means of production is divided among many people, acting independently, that nobody has complete power over us, that we as individuals can decide what to do with ourselves." The book teems with happy phrases and telling illustrations, as when the author remarks "that while the last resort of a competitive economy is the bailiff, the ultimate sanction of a planned economy is the hangman." Quoting from Hölderlin, "What has always made the State a hell on earth has been precisely that man has tried to make it his heaven," the chapter on "The Great Utopia" shows how, from the French foundations of modern Socialism right down to the most up-to-date of planners, it is evident that those who do not submit to the dictates of these reformers must be "treated as cattle."

B.B.C. Science

THE presentation of science by the B.B.C. has frequently proved disappointing, and of recent months we have felt obliged to criticise certain shortcomings. We recognise, of course, that from time to time B.B.C. producers do make commendable efforts to meet the curiosity that the public has in matters scientific, and we should like to comment on a recent programme about plastics and also on the science items broadcast in the "Your Questions Answered" feature. "It Began with Celluloid," programme broadcast on Home Service, was written by a chemist, Dr. R. N. Haward, in collaboration with the B.B.C. producer, Edward Livesey. In the lecture hall an audi-

ence of laymen could be shown actual samples or photographs of plastic materials, but in that respect the radio producer labours under a disadvantage, and will continue to do so until television is restored. But in this particular programme the wide range of plastic products was well conveyed in a series of vivid radio "snapshots." This technique, comparable to the dramatised documentary films like *March of Time*, was cleverly used, and listeners must have been left with some sharp impressions of the infinite variety of uses that plastics find. "Your Questions Answered" is a different kind of

programme. It provides straight questions posed by servicemen, and invariably contains one item of scientific interest. For instance, Dr. D. P. Riley, a Cambridge chemist, recently dealt with an inquiry as to the nature of proteins, and made a very good job of it. Several younger scientists have contributed to this feature, including Dr. David Evans, Dr. Geoffrey Bourne, and Dr. S. Gregory. Those of our readers who are interested in the problems of using radio to convey to the public some idea of the great advances made in science and technology will find this programme enlightening.

LETTERS TO THE EDITOR

Scientific Information

SIR.—The article by Dr. S. C. Bradford on the "Availability of Scientific Information," published in your issue for April 8, appears likely to create some misconception as to the services provided by the Science Library in respect of bibliographical information on scientific and technical subjects. While the relations between the Library and the British Society for International Bibliography have always been most cordial and mutually helpful, it would be totally incorrect to assume that the Society enjoys any special privilege in respect of the supply of information beyond those open to any corporate institution, or indeed any individual member of the public, interested in science and technology.

The Science Library is a national library maintained by the State, and such services as it can render are available without charge as a rule. There is no question of its participating in any scheme of self-supporting information service operated upon any basis of payment for "services rendered." Like any other Government institution, it makes certain charges designed to meet the costs of publication in special cases where widespread availability of particular information is desirable. Costs are not designed, however, to cover any expenses of compilation of information where that is regarded as the normal routine of the institution. In general, a bibliography is compiled to meet the need of the investigator at a distance, who cannot visit the Library and compile his own from its available resources, which again cannot be loaned for the purpose because of their special character. Although the resources of the Library for the compilation of comprehensive bibliographies are indeed very considerable, I should very strongly deprecate any claim that the Library possesses any peculiar resources that enable information on specific subjects to be produced with a com-

pleteness or facility exclusive to this Library, or to its staff; especially is this true at the present time, when much of the material formerly collected is unobtainable, and the technical staff is much reduced, owing to the war.—Yours faithfully,

E. LANCASTER-JONES,
Keeper, Science Library,
Science Museum.

International Post-War Trade

SIR.—In your recent article on "The Location of Industry," you refer to some of the difficulties of re-establishing international trade. At present we are all in the dark as to the potential possibilities and, consequently, handicapped in planning a change-over. Would it not be a practical step for all free countries, and those who can speak for the occupied countries, to state now what imports each will allow and what exports each desires? This can be guided, to some extent, by 1939 trade and should be in terms of specific products, tonnage and not values. In some cases large differences can be foreseen, while if, on the contrary, negative results are obtained, each exporting country, and correspondingly its affected industries, will obtain a fair indication of the prospects or, at least know the worst. A picture will also result as to the ability of the exporting countries to take imports, and a measure of reality be obtained.

The position of enemy countries can be assessed arbitrarily on a realistic basis. It is important that these matters should crystallise as quickly as possible, and we suggest that the immediate effect will be to stimulate interest and to learn which way the trend of world trade is taking, i.e., to Narrow Nationalism or International Trade.—Yours faithfully,

for ATHOLE G. ALLEN (STOCKPORT), LTD.,
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The "Master Key" Industries

The Future of the Laboratory Equipment Industries

by NORMAN SHELDON, A.R.C.S., F.R.I.C.

THE invitation to contribute an article on the future of the British Laboratory Ware Industry was very welcome. If Great Britain is to maintain her place as one of the great powers and to play her part in the reconstruction of Europe, these industries have a very important work to do. They provide the instruments and materials with which our scientists work, with which they carry out research or control and develop our industries. They also provide the instruments necessary for the direction of modern warfare. They are the most fundamental of all industries, as by their labours new industries are created and old ones given renewed vigour. Coal and oil will not last for ever and the workers in the laboratory equipment industries must supply our scientists with the instruments and materials needed in devising substitutes. But before we consider their future let us glance at their past history.

Napoleon's Telescope

The early scientists made most of their apparatus with their own hands. They spent days or months in carrying out simple experiments which are performed in a modern laboratory in a few minutes. Gradually, it was found necessary to call for the assistance of manufacturers who had the plant and the skilled artisans capable of producing special equipment. Such articles usually involved the use of glass or porcelain, and the production of laboratory equipment in these materials appears to have attracted the attention of certain manufacturers about 200 years ago. The demand was extremely small and the work must have been undertaken more in the spirit of service to the scientist than with any hope of making profits. The production of optical glassware began in England, Germany, and France, and as the use of optical instruments extended to the armed forces and to the general public the production of optical glass was probably the parent of the many specialised branches of industries which now serve the scientist. Napoleon is said to have used an English telescope. There is evidence that Wedgwood made porcelain for laboratory use as early as 1750, and that the Worcester factory made it early in the 19th century.

During the Franco-Prussian war of 1870 Bismarck found that the German Army was depending on England for certain supplies of optical instruments. He and his advisers realised that if Germany was to conquer the rest of Europe they must gain control

of the scientific industries which they saw to be essential for success in any future war. They were the first to understand the importance of science and scientific equipment and they planned the world monopoly of these industries which Germany held in 1914. The development of the production of optical and scientific glassware encouraged the scientific outlook and provided the equipment which led, quite logically, to the establishment of the great chemical industries that made German science famous. In Germany the industries producing instruments and every kind of laboratory equipment worked in co-operation with the bigger and newer industries which they had helped to establish—the chemical and explosive factories and the dyestuffs factories. They gave service to these industries just as in the early days they gave service to the individual scientists. They made their own industries profitable by giving service to scientists all over the world, but where necessary they had the wealth of the Imperial treasury behind them. British scientists began to rely on German equipment and service and our Government remained sublimely ignorant of what it all meant.

Suddenly a change came. The declaration of war in 1914 cut off supplies of many vital materials and created a need for many more. We in Britain had no dyestuffs for our uniforms or T.N.T. for our shells. Before these and many other munitions of war could be produced it was necessary to establish laboratories for research and for the control of production. Manufacturers with suitable experience were pressed to begin production of many kinds of laboratory equipment. Scientific societies set up committees to work out formulæ and to co-operate with the manufacturers. The spirit of service to science and to the country was awakened; gradually the gap was filled and a brand new British laboratory equipment industry played an essential part in winning the war.

"Safeguarding"

When the war was over, the British manufacturers looked forward to developing these industries systematically and efficiently under peace conditions. A committee appointed by the Government declared that the war had shown that home supplies of these commodities were essential for the safety of the Empire. They recommended that "these small but 'key' industries should be maintained in this country at all hazards and at any expense," and informed

the Government that "no ordinary economic rules apply to the situation of these minor but important industries. They must be kept alive either by loans, by subsidy, by tariff, by Government contracts or in the last event by Government manufacture. They must necessarily be subject to Government supervision." The Government passed the Safeguarding of Industries Act (Part I) which imposed a tariff that became known as "Key Industry Duty." They then left them to work out their own salvation in the face of a flood of competition from Germany. Ordinary economic rules were allowed to apply. To make matters worse, many British scientists declared that they must purchase German equipment again until the British manufacturers would take the trouble to compete in quality and price. They ignored the fact that the "manufacturers" were usually members of their own profession, plus the men and women who actually did the job. The former might need years of research and the latter years of experience before they acquired the knowledge and the highest skill, and neither wished to work for a slave wage any more than did their customers. The spirit of co-operation died; many firms gave up the production of laboratory equipment altogether, while others continued to make such items as derived a measure of protection from the duties which had been imposed on imports and which were wanted in sufficient quantity to keep a few men steadily employed. The most serious result of this desertion of a vital industry by the Government and the consumer was the lack of adequate research which was made impossible owing to the lack of funds. Funds for research could only come from profits and these were virtually non-existent. Many who attempted to promote research simply lost their money. It is not necessary to detail the failures and the successes; most of them are well known to every reader. The present war found every section of the industry ready to play their part in the fight against aggression, although in many cases they did so with the opposition rather than with the assistance of Government departments: but that is a strange story which needs an article to itself.

Plan for the Future

The time for planning for the future has now arrived. The importance of science is now recognised by all, but with the spectacular achievements of our scientists so prominently before the public, there is a danger that these small scientific instrument and equipment industries which made it all possible will once again be forgotten. Many Members of Parliament have joined the Parliamentary and Scientific Committee—the number has doubled in the past 12 months—and a number of Cabinet Ministers

are trained scientists. If we do not get the support we need it will be our own fault.

Some readers of this journal will be manufacturers of laboratory equipment who are already aware of my proposals, but the majority are scientists who are their customers, and it is to them that I appeal most particularly. I believe it is essential to revive the spirit of co-operation between the manufacturer and scientist which I suggest must have existed in the early days of science, and which I know existed from 1914 to 1918. The laboratory equipment industry must exist to give service to science; in fact, I should like these industries to be known as the Laboratory Equipment Service. They are not industries in the ordinary sense of the word, and much of the money that is paid to them is for service and not for goods alone. The scientist must take an interest in the problems of the manufacturer, just as he expects the manufacturer to take an interest in his own special needs. I know it is a great temptation to save money out of an inadequate equipment grant by beating down the price. It is the line of least resistance, but it is not sound. I suggest that the proper course is to press for adequate funds.

Educating the Public

Let us consider some of the problems that arise. First of all there is the attitude of Parliament and of the general public who supply the funds with which the products of these highly specialised but fundamental industries are purchased. They must be brought to understand their importance and to take whatever action is necessary to ensure that British science has British equipment and that this equipment is so good that all the world will buy it. If public support is to be achieved we must have a distinctive title. Debates in the House of Commons and week-end speeches by our politicians are always producing references to our "key" Industries. The speakers are rarely in agreement as to what the word "key" means; it may be steel or coal or machine tools, but it is certainly never applied to the only industries which were given the official label "key industry" by the Board of Trade. We have lost our copyright and must find something more suitable. As the object of our work is to provide the tools with which scientists probe the mysteries of nature in order to build up our modern civilisation, I suggest that we are providing the master keys on which all other industry depends. Can a better title than "Master Key Industries" be found?

We now come to the problem of Germany. I maintain that Germany has forfeited her place as a world supplier of "Master key" materials. She has used these industries to further her plans for

world conquest. Her exports were used to prevent her enemies from building up their own scientific industries and by this means she weakened their defences against aggression. Where necessary, these exports were maintained by subsidies, and in at least one case where British makers were gaining ground, they actually received written threats of drastic action in another field if they did not yield to the German scientific product. The evidence against Germany is clear and the penalty should be prohibition of export of "master key" materials for a very long time.

The Call for Technical Excellence

When the war is over Britain will find that her former customers have built their own factories to provide the necessities of life and that we can only pay for our imports with goods of higher quality or greater technical excellence than they can make themselves. Our scientists have many difficult problems to solve and they must be served well by those who provide their equipment. The position of the "master key" industries in Great Britain must be made unassailable. They must be assured of the whole British market and as much as possible of the export market. In the interests of our whole industrial organisation, it must be arranged that they shall be developed in such a manner as to enable them to give the finest possible service to the industrial machine as a whole. They must be provided with ample funds for research.

If these things are to be done we must break away from old traditions. In the past the relation between scientist and the master key industries has been that of consumer and producer, the consumer buying in the cheapest market and the manufacturer having no security. In many cases the scientist had no say in the purchase at all; he had to use whatever was provided by a buying department whose sole concern was to save money. If these industries are to be efficient they must be assured of adequate output and fair or even generous prices over a long period. In order to secure these conditions there must be complete freedom from foreign competition as we have known it in the past. Instead, there must be co-operation with foreign makers, exchange of information, with imports only allowed under special licence. There must also be control over competition between British factories. Where there is only sufficient business to keep one factory employed, steps should be taken to prevent other firms from competing. This applies to the manufacture of particular instruments, groups of instruments, or materials, and even to the distribution of master key materials. In the past there have been two forms of competition that have been very

detrimental. One interferes with production and service, the other with service alone. The majority of factories engaged on the production of scientific instruments have a tremendous variety of articles to produce. Half of their output may be confined to a dozen items and the other half split up over hundreds of specialised articles sold in ones and twos, which could not be made at all if the plant was not kept fully employed on the much bigger production of less specialised goods.

Frequently it has happened that someone searching for cheaper apparatus has persuaded a new firm engaged in another industry to start making the commonest and simplest articles at a lower price and of inferior quality. This cuts out the "bread and butter" of the established firm, leaves them all the difficult work, and may check progress completely. This form of competition has been encouraged under the label "school quality" and there can be no action more dangerous to the efficiency of these industries. "School quality" is not profitable even for schools: many have proved that to be true. The educational business is the "bread and butter" of many sections and those responsible for buying the laboratory equipment should try to ensure that their buying fits in with a general plan for the efficient development of the master key industries as a whole.

Misplaced Economy

As I said earlier on, the solution lies in better grants for equipment so that the initial purchases may be of good quality and the replacements less frequent. Cheapness is good if it can be achieved by simplification of design or by an increased output from a particular plant; it must never be encouraged if it hampers progress as it has done in the past. I mentioned competition which interferes with service. By that I mean the kind of thing that occurs when a local education committee may ask a local pharmacist to supply the laboratory equipment for their local schools. This and other similar ways of encouraging inexperienced third parties "to take a bite out of the cherry" can do no one any good and if developed to any extent, can seriously interfere with the service that should be included in the cost of all laboratory equipment.

By now the reader will probably have decided that this article is nothing but a plea for money for makers of laboratory equipment, and so it is, but only in order that the money may be spent for the benefit of the country. If we do not speak frankly about these matters now it will be impossible to get the necessary support. It should be remembered that there are sections of these industries who supply equipment to every chemical laboratory in Great

Britain and in which the turnover in pre-war days did not exceed £15,000 per annum including the imports from Germany. In at least two sections no British maker sold as much as £6000 worth per annum—less than £1 per laboratory. The corresponding German output was about £80,000, distributed all over the world and, owing to their low costs of production, it probably represented £160,000 at British prices. No wonder Germany could keep on bringing out new apparatus and improvements in quality! In the U.S.A. the amount spent on scientific equipment is about three times as much per head of population as is spent in Britain, and the population is three times as great, so that we have an example there that justifies an appeal for more funds for British laboratories. In America they have dealt with competition sensibly; in spite of the anti-trust laws they have reduced the number of makers of one master key material with which I am familiar to one only. A second which started was found to be nothing but a nuisance cutting in on a small market, and was closed down. In Britain to-day we have four firms playing about with a turnover that cannot be more than one-tenth of that of the one American factory. How can we compete in the world markets under such conditions; how can we even serve our own people well?

A Central Council

I meant to refer to other points but space is limited. Where does the solution lie? In my opinion there must be a new form of co-operation between the user and the manufacturer. The manufacturer needs assistance of a kind which can only be arranged with the good will of the consumer and of the Government. In a memorandum which I circulated a year ago, I discussed the importance of co-operating with other countries to prohibit German exports, of planning manufacture in countries with a reasonably large home market, and of dividing the markets of the world so that each factory may have an adequate output and be placed in the best strategic position. I raised many points that are very controversial and I suggested that there should be some central council representing the Government, the manufacturers, and the users of scientific instruments and materials. This body should be given the job of encouraging and developing the master key industries and should represent Great Britain in any negotiations or discussions with other countries. This council should control imports, licences, and monopolies; ensure that research funds are adequate and are spent to the best advantage; and be prepared to play an important part in leading the technical industries of the Empire to greater achievements.

During the next 25 years many new indus-

tries may arise as a direct result of the activities of the master key industries and the scientists to whom they give service. If we get together to put our own house in order may we not be able to influence, for good, the application of the discoveries for which we are jointly responsible?

Fluorspar Meeting

Derbyshire Producers Report Progress

THE first annual meeting of the Derbyshire Fluorspar Producers' Association was held at the Crown Hotel, Matlock, on April 4. In his speech the Chairman reminded them that the Association had been formed as the result of the Fluorspar Controller's first annual report which contained criticisms and suggestions in regard to the industry. Before the war, the fluorspar industry was in a chaotic and unprofitable condition, and, in view of the vital part fluorspar plays in the manufacture of steel and metals, the position had at one time caused serious misgivings. They were, however, overcoming many of the difficulties, and were confident that in the near future the industry would be established on a sound and national basis. The Fluorspar Controller (Mr. W. T. Vizer Harmer) and his staff had been most helpful, and as the result of two deputations to London to meet the Control, grades and prices had been agreed, and steps were being taken to bring them into operation at an early date. Producers outside Derbyshire had shown interest in the Association's work, and meetings were being arranged with a view to getting grades and prices adopted on a national basis.

The time for unspecified and unguaranteed fluorspar content would soon be past, and the Association would continue to work, in conjunction with the Control, to establish better and uniform grade and prices. A good deal of development work had taken place during the war, and producers were justified in asking for help and protection to achieve their aims. Merchants had played an important part in the past and the Association had opened a section whereby approved merchants could be associated with the producers, and their co-operation continued.

New Officers

Officers elected for the ensuing year were: *Chairman*, Mr. Frederick Franks; *Deputy Chairman*, Mr. Charles A. Jones; *Secretary*, Mr. H. Hebblethwaite, 39 Foxwood Avenue, Sheffield, 2. *Committee*, one member from each of the following firms: Clay Cross Co., Ltd.; Blanchland Fluorspar Mines, Ltd. Constables Quarries, Ltd.; R. C. Conway; Ernest Hinchliffe, Ltd.; H. Taylor; James Wilkinson & Sons, Ltd. (Glebe Mine); and William Smith (Fluorspar), Ltd.

Development in Laboratory Apparatus

Some Recent Advances

by R. H. POWELL

THE business of the maker of laboratory apparatus is one of great complexity. It necessitates the design and manufacture of a wide variety of apparatus and instruments, all in quantities which, measured by standards prevailing in other industries, are small—often uneconomically small. No mass production assembly lines are possible and manufacturing methods, therefore, need to be adapted to the variety and volume of output. Here, despite the machine-versus-man controversy which wartime conditions

naturally militate against the conditions for economical production, and it were well, therefore, that the worker should confer with the maker, so that from their joint knowledge there can be evolved designs, which satisfy the one while not greatly disrupting the smooth flow of production by the craftsmen of the other.

These aspects of laboratory apparatus manufacture have been brought into some prominence during the war, when the nation's mind is attuned to the necessity

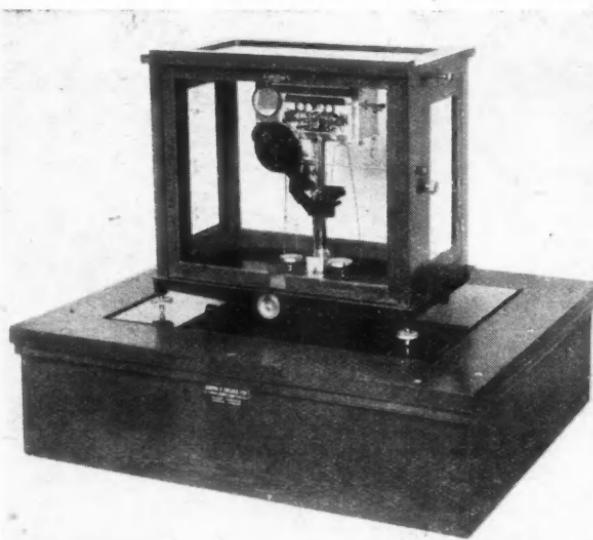


Fig. 1. G. & T. Anti-vibration balance table.

[By courtesy of Griffin & Tatlock, Ltd.]

inevitably stimulate, craftsmanship retains its old-time ascendancy, and for the laboratory and the research worker it is fortunate that it should; for only those who have had experience of standardisation committee work know how difficult it is to try to reconcile these workers to the adoption of cut-and-dried standardised apparatus.

Individual idiosyncrasies or personal preferences for this method or that construction play a very large part in determining the selection of the apparatus which will be installed in a laboratory; and the apparatus manufacturer, if he is not to hinder, but to further the applications of science to industry, must be prepared to accommodate himself to the needs—real or fancied—of the worker. These varied personal require-

ments naturally militate against the conditions for economical production, and it were well, therefore, that the worker should confer with the maker, so that from their joint knowledge there can be evolved designs, which satisfy the one while not greatly disrupting the smooth flow of production by the craftsmen of the other.

These aspects of laboratory apparatus manufacture have been brought into some prominence during the war, when the nation's mind is attuned to the necessity for conserving man-hours, and standardisation projects are more in evidence than formerly. That they will continue so to be in rational schemes of post-war planning now seems certain. When one surveys the work accomplished by the British Standards Institution, the Institute of Petroleum, the Standardisation of Tar Products Test Committee, as well as by the many other official and unofficial bodies, the conclusion is inescapable that standardisation will extend. That it has gone so far is evidence that in many industries it is acceptable. Nevertheless, so far as laboratory apparatus (outside specifications) is concerned, flexibility by the maker and adaptability by the laboratory worker will for long continue to be required.

Meanwhile, the search for new methods

to meet changing conditions brought about by new circumstances continues. The following account is of new items which have recently been made available.

In many war factories the appreciable time involved in transmitting samples from the works to laboratories at a distance is a factor of such real importance that, despite the obvious disadvantages, there is no alternative but to instal the laboratory within the works itself, close to the site where the analyses are required. In foundries, for example, analysis for carbon content is required before pouring castings from a crucible of molten steel. Five minutes to send the sample of drillings from a trial ingot from the foundry to the laboratory means five minutes more of maintaining furnace temperature, consumption of hundreds of kilowatts, men standing idle, etc. But to instal the laboratory close to the site where the analyses are required means that the analytical balances will be subjected to vibration from heavy machinery near by, and in some cases this has been so severe as to cause fractional weights of low denomination to jump out of the pan. Various means have been proposed for the solution of the problem: the well-known "shock absorbers" are useful where the vibration is occasional or mild; the use of a heavy slate slab supported on cantilever brackets cemented into the wall, with strips of lead between brackets and slab, is recommended by Pregl; in exceptionally severe cases a concrete pillar extending below the foundations of the building is the approved remedy.

Anti-Vibration Balance

Interest, therefore, attaches to the G. & T. Anti-Vibration Balance Table shown in Fig. 1. In one case the laboratory was built on a hollow floor, and surrounded on all sides by test rooms and workshops. The vibrations were brought about by the surging from accelerating and slowing aero-engines on test, from heavy power hacksaws cutting steel bar, and by medium-high frequency vibrations from grinding machines in the fettling of castings. The graticule of a projection-reading balance appeared as a continuous blur on the scale. In these severe conditions a complete cure was provided by the G. & T. Anti-Vibration Balance Table. This table consists of a heavy oak case containing, in the corners, four sets of four tetrahedrally-arranged solid rubber spheres, on which rest two very heavy lead sheets interleaved with a composition cork sheet, which provides frictional damping on the surrounding case. A sheet of armoured plate glass rests on the top. The system constitutes a pendulum with a high moment of inertia.

The polishing of specimens for metallographic examination is an art not amenable to standardisation in its finer aspects. Its

technique requires a delicacy of perception and a sensitivity of touch, coupled with scrupulous cleanliness, that can be acquired only by experience. Nevertheless, the materials used play a large part in the attainment of satisfactory results; especially is this true of the powders used for polishing. One of the materials largely employed is alumina, chosen because of its hardness and rapidity. The element of personal preference has operated against its more widespread use, but variability within material from different sources has been a contributory element. Recent investigation has shown that, by the exercise of the utmost care in manufacture, under laboratory conditions of thermostatic control and air conditioning, uniform batches of polishing alumina can be prepared if three factors are borne in mind: the hardness, the grain shape, and the particle size analysis of the finished product.

Control of Polishing Alumina

The hardness is controlled by the calcination temperature, which is precisely regulated. It affects the rapidity with which a specimen can be polished, for the edges of a suitably hard polishing material do not easily become blunted. Grains which have become dulled present a relatively smooth surface to the specimen, and having little power to remove metal, they may give a high apparent surface polish which is akin to burnishing. This condition is one to be avoided for metallographic purposes, since burnishing is brought about by surface flow, metal distorted in the earlier history of the specimen is not removed, and the edges of pits (and with soft-grain metals, the whole cavity) may be flowed over.

The grain shape is a factor of importance. Hitherto scratching troubles have been not uncommon when alumina has been employed. It is now known that these are frequently due to the presence of acicular (needle-shaped) particles. It is evident that such a particle can—depending upon its orientation on the polishing disc—plough a deep furrow, or a broad, shallow track, or a narrow, shallow track. Microid Polishing Alumina is so made that the particles approximate as nearly as possible to a regular polyhedral shape. Thus, whatever their orientation on the polishing disc, they present a face or edge no one measurement of which greatly exceeds another, and deep scratches are not, therefore, produced.

The third important factor is the particle size. Where alumina is not graded with exceptional care the inclusion of particles much larger than the average will always produce scratching. In Microid Polishing Alumina not only is the greatest care taken in the grading, but the proportions of particles of various sizes are controlled to produce the optimum mixture for rapid work.

If these proportions are so chosen that the interstices between the closest packing of the larger particles are filled up by smaller particles, then the "surface density" of the alumina on the polishing disc will be a maximum. There are three grades of Microd Polishing Alumina available, namely: 5/20 fast, 4/35 medium, and 3/50 slow. The first figure indicates the diameter in microns of the maximum particle size present. The second figure indicates the percentage of material finer than one micron. This new alumina is available in an aqueous suspension needing only dilution with distilled water before use.

The grinding of samples of coal, minerals, ores, colours, soil, chemicals, drugs, cortices, grains, etc., in the laboratory either before analysis, or for the preparation of small batches, is a constant problem. The Raymond Laboratory Mill (Figs. 2 and 3) has recently been made available and, de-

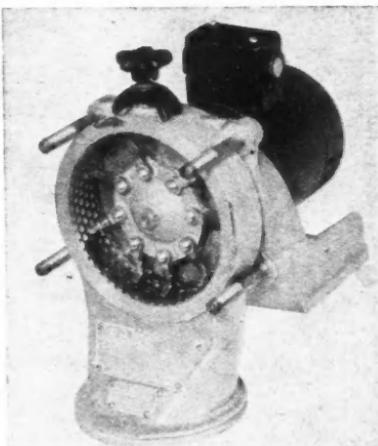


[By courtesy of Griffin & Tatlock, Ltd.]

Fig. 2. Raymond laboratory mill.

signed on principles which have found successful application on the large scale, incorporates features of interest. The power unit is a special $\frac{1}{2}$ H.P. motor designed to run at 10,500 r.p.m. It is bolted to a phos-

phor-bronze casting, about 6 in. dia., which also forms the mill housing. On its spindle is mounted a rotor provided with eight, high-carbon steel hammers. These have a small clearance (about 1 mm.) from a perforated steel screen with which the interior



[By courtesy of Griffin & Tatlock, Ltd.]

Fig. 3. Raymond laboratory mill, showing hammers and interchangeable screens.

of the housing is lined. Five different sizes of screen are supplied: viz. $\frac{1}{4}$ in., $\frac{1}{8}$ in., $\frac{1}{16}$ in., 0.024 in. dia. holes, and one with slots 0.01 by $\frac{15}{32}$ in. for use with sticky materials. They are easily interchangeable. The hopper is mounted on the side of the housing, being clamped by four hand-nuts. The material to be ground should first have been reduced to pass $\frac{1}{4}$ in. mesh or finer, and is then charged into the hopper. Feed is by a hand-operated worm, which enables the rate to be adjusted in accordance with the type of material to be ground. As the worm is rotated the material enters the centre of the grinding chamber, is flung to the periphery where it is disintegrated between the steel faces of the hammers and the screen. When it is reduced to a size that will pass the particular screen in use, it is swept by the hammers through that part of the screen above the inverted funnel at the base. Attached to this funnel by a spring clip is a cloth tube, which filters out excess air, and the comminuted sample then passes to the container below. The mill is easily cleaned, either by being taken to pieces and washing the parts separately, or by carefully pouring water or other suitable solvent through the hopper when the mill is in operation.



Mr. F. A.
Greene.

THE 22nd annual corporate meeting of the Institution of Chemical Engineers was held on April 14 at the Connaught Rooms, London, W.C.2. Mr. F. A. Greene was in the chair, and during the course of the meeting was re-elected president for a further year.

Speaking on the annual report, Dr. A. J. V. Underwood, joint hon. secretary, stated that details of the degree course in chemical engineering drafted by the council would be issued shortly. He also commented on the very large amount of detailed work which had devolved upon the sub-committee that drew up the code of standards for pressure vessels. Items on the accounts to which Mr. H. W. Cremer, hon. treasurer, referred included the first subscription paid by the institution to the Parliamentary and Scientific Committee, the expenses incurred in connection with the Hinckley Medal (£78 3s.), and the sum of £500 put to the

“Our Title : A Reminder”

The President's Address

It is a sign of the times, and a particularly encouraging one, that there should be so much looking ahead and planning for the future. Our own Institution is not unmindful of the need for this, and I feel sure that we shall not be found wanting in so far as our own contribution to post-war reconstruction and development are concerned. Thoughts for the future, however, should be closely linked with consciousness of the present and the past. It is for this reason that I suggest to you that for a short time this morning we should "look into the pit whence we are digged, and to the rock whence we are hewn."

**Institution of
Chemical Engineers**

post-war publications reserve. Mr. Cremer also drew attention to the purchase of £1600 of 3% savings bonds.

The following officers were elected for the following year: President, MR. F. A. GREENE; vice-presidents, DR. H. J. BUSH, SIR ALFRED EGERTON, MR. H. GRIFFITHS, DR. E. W. SMITH; joint hon. secretaries, DR. A. J. V. UNDERWOOD, MR. M. B. DONALD; hon. treasurer, MR. H. W. CREMER; members of Council, MR. W. F. CAREY, DR. R. GILMOUR, MAJOR V. F. GLOAG, DR. F. A. WILLCOX; associate member of Council, MR. W. K. HUTCHINSON.

Presentation of medals followed, the winners of the Osborne Reynolds Medal and the William Macnab Medal receiving tokens of their awards; they will receive the actual medals later. MR. HUGH GRIFFITHS was awarded the Osborne Reynolds Medal for his valuable services to the Institution over many years. The Moulton Medal went to MAJOR V. F. GLOAG and MR. R. J. BARRITT for their paper on "The Manufacture of Sulphuric Acid in Contact Plants," and the Junior Moulton Medal and prize of books to DR. H. R. SOPER for his paper on "The Industrial Utilisation of Peat." The William Macnab Medal, for the best answers submitted in the Associate Membership Examination for 1943, was awarded to MR. W. F. HASTIE.

Of one thing we are confident, namely, that the sub-soil and the foundations are good, but it is not of these that I wish to speak just now. It is rather to the structure itself that I would draw your attention, and more particularly to the manner of its description.

Now, in giving a name to the subject of this address, I had in mind that the word title has several meanings; what I have to say concerns three of these. The first, and perhaps the most common, is an inscription put over anything as the name by which it is known; secondly, the instrument which is evidence of a

right; thirdly, an appellation of dignity, distinction, and pre-eminence.

In case it may be thought presumptuous on my part, as president of so comparatively young an institution, to dwell upon the last of these, I shall confine my remarks almost entirely to the first two.

Chemical Engineers Defined

First, then, our inscription—"The Institution of Chemical Engineers"—and ourselves—"Chemical Engineers." Let me say at the outset that I personally am not in the least doubt as to what we profess when we style ourselves in this manner. In my own case, it was originally intended that I should earn my bread as an analytical chemist, but later I changed over to engineering. And if I were asked with what professional activities I have been principally concerned during the ensuing years, I should reply: "With the design, construction, installation and operation of chemical and allied plant and the lay-out of works which comprise these."

You will observe that this description (I wrote it before I checked the point) is very similar to, although it is perhaps not quite so high sounding as the definition of a Chemical Engineer approved by the Council of this Institution at its inception, *viz.*, "A chemical engineer is a professional man experienced in the design, construction and operation of plant and works in which matter undergoes a change of state and composition." One could not wish, I think, for a clearer and less ambiguous definition than this; it is one which is not only a statement of the primary functions of a Chemical Engineer, but also one which is indicative of the very foundations of his belief. There have been fuller and more elaborate definitions and this may be the reason why some people appear quite incapable of appreciating our functions and our aims, in spite of the fact that we have been in existence as an organised profession for nearly a quarter of a century.

To our critics, apparently, there seems nothing strange or irregular in the fact that mechanical, electrical, marine, gas, aeronautical and other branches of engineering have each sprung from the loins of the ultimate parent of us all, *viz.*, Civil Engineering, for there were only two recognised branches of engineering in

the old days, Civil and Military. The need for a similar sub-division of engineering in the case of our own particular section evidently seems less appropriate to these critics, however, and this in spite of the fact that all engineering is fundamentally applied physics in some form or other. Chemical Engineering, as we all know, is essentially applied physical chemistry, but in practising it, we are mainly concerned either with physical operations entirely, or with the purely physical aspects of chemical reactions, as in the transportation of solids, fluid flow, agitation and mixing, transfer of heat, and so on. Moreover, in order to obtain the product of a chemical reaction in a marketable form, the further operations involved, such as filtration, evaporation and distillation, crystallisation, drying, grinding, and all the rest, are also physical operations. Similarly, the use of the indicating, recording and regulating appliances which are employed to control these operations are usually the result of applied physics, (in other words, engineering), rather than the application of purely chemical principles.

University Training

So far as the Council of the Institution is concerned, we regard our profession as quite definitely taking its place beside its elder brothers, Mechanical and Electrical Engineering, in the great family of engineers. Let there be no mistake about that. Our views concerning the university training of Chemical Engineers are fully in accord with this outlook, as are those of the University of London, the Senate of which has seen fit to include the teaching of the subject within the Faculty of Engineering and not within the Faculty of Science. In every essential, both theoretical and practical, the Chemical Engineering curriculum of the University of London is parallel with that prescribed for First and Second Year students in Civil, Mechanical and Electrical Engineering. The main difference and one which is not so widely appreciated as it should be, is that the Chemical Engineering student is required to devote a further *two* years to his selected branch of studies, whereas those in the other branches named complete their Courses for the B.Sc. Degree in a further one year only.

It follows that, although the emphasis

is on engineering throughout the whole course, there is an adequate proportion of time available for the study of those basic principles of chemistry which are essential for a proper understanding of the various branches of this science, and for an awakening to their relationship to industrial research on the one hand and to industrial applications on the other. The foundations laid are amply sufficient to enable a person to supplement at a later stage his existing knowledge of the more abstruse regions of the subject.

Co-ordination

A feature which we consider of paramount importance throughout the Four Years' Course of study is the inter-relation and co-ordination of the various sub-divisions of the work—mathematics; physics; chemistry; civil, mechanical and electrical engineering; metallurgy, and so on. It is no secret that in the past too little attention has been given to this question of the inter-relation and co-ordination of studies in undergraduate work. Subjects have tended to be dealt with in water-tight compartments, and, sad to relate, collaboration between teachers has been too frequently inadequate. It is obviously for the teachers themselves to blend their several contributions into a living and harmonious whole, not for the student to struggle with a mass of seemingly unrelated facts, sometimes ill-digested at that, and some of which may appear to him through lack of proper interpretation apparently without practical significance. On the other hand, in framing their courses of study, let our teachers not forget those profoundly wise words of Aristotle—"It becomes neither a free man nor a great man to look every time for what is useful." Otherwise they will lose a golden opportunity of combining professional training with general culture, which, you will agree, is a "consummation devoutly to be wished."

Provided these desiderata are forthcoming, the Undergraduate Course in Chemical Engineering provides one of the finest all-round trainings in applied science in existence, and this view is shared by some of the outstanding educational and industrial authorities of the day.

If I were asked what I considered to be the chief qualities which characterise the

best type of chemical engineer, I should reply somewhat as follows: First, his balanced way of looking at things as a whole and not piecemeal, a result no doubt of the blend of science and engineering in his earlier training and one which leads him to base his work on principles rather than the ready-made views of others. Secondly, no doubt also a result of his combined education, his impartiality in assessing the merits of the respective contributions of the chemist and the non-chemical engineer to any scheme which is referred to him, or in which he is required to participate. Thirdly, his ability to co-ordinate the work of others, for, provided his teachers have done their work properly, he himself is the result of a fully co-ordinated effort in regard to the individual subjects which together form the basis of his knowledge.

It must be admitted that these are very desirable qualities, and if by any ill-chance they are lacking, immediate steps should be taken to acquire them. They are qualities which render the Chemical Engineer indispensable not only in small works, where the variety of technical staff is of necessity restricted, but equally of value in larger organisations, where he provides a very essential link between the plain scientific and the plain engineering staffs, who are by no means always ideal stable companions when left to themselves.

The Importance of Design

Apart from this, however, there is a special significance in the order of the words "design, construction and operation" in the definition of Chemical Engineering adopted by our Institution. As Dr. Underwood very rightly pointed out in an address which he gave some years ago to industrial chemists (I quote his own words): "Skill merely in the operation of plant can be acquired by a good process hand or foreman, and, when the design is forthcoming, the construction of the plant can be safely left to the mechanical engineer, provided he possesses the requisite experience in the methods of fabrication involved, but neither construction nor operation calls for chemical engineering knowledge in the real sense of the term. It is in the actual *design* that knowledge of the fundamental principles of chemical engineering is needed, and, since an efficient design

obviously implies familiarity with methods of construction and the problems met with in practical operation, both construction and operation may be considered as being included in design."

These are very true words, and it follows that the primary duty of the chemical engineer is not merely to *catalyse* the work of others. He has a very distinct function of his own, and his training should be such as to make him capable in appropriate circumstances of initiating processes and operations on his own account. It is largely for this reason that it is becoming realised more and more in industrial concerns that the chemical engineer is needed as an integral part of the organisation, not only where chemicals are being manufactured, but also throughout the great range of so called "process" industries which provide for the increasingly complex requirements of our every-day life. I would here hasten to add that in stressing the value of the man who has taken a degree in chemical engineering (whom I like to think of as the "true-bred" Chemical Engineer) I am in no way seeking to disparage those who have or will become Chemical Engineers by adoption, *viz.*, those who, starting as chemists, later superimpose the study and practice of engineering upon their early training and experience in chemistry, and *vice-versa*.

The fact that our Institution numbers amongst its most capable members many persons of this kind is itself sufficient evidence that no deterrent is intended in these remarks of mine to others who may wish to qualify as chemical engineers in a similar way. The post-graduate type of training is fully recognised in this country as it is elsewhere, and it is well that it should continue so to be. The resulting products, of course, are by no means identical, but with such a vast field in which to practice, there is no reason whatever why they should be so.

Centres of Training

In the future we look forward to an increasing number of teaching centres becoming available, and our Institution is prepared to assist to the maximum of its ability in furthering such developments. It so happens that some of our members were amongst the pioneers in the teaching of chemical engineering in this country, and such is

their enthusiasm and zeal for the cause that I have no doubt whatever that they are perfectly willing to make available to others the benefit of their knowledge and experience, and to assist educational authorities if asked to do so in putting to the best use the means at their disposal.

Similarly, I should like to think that the fullest collaboration will be created and maintained between centres of training on the one hand and ourselves as the professional body chiefly concerned on the other, for only good can surely come from a free interchange of views in matters of this kind. In industry people are at last coming to realise that self-interest and secrecy are not so essential as they were once thought to be. In the realms of education, where competition and the profit motive are (or should be) entirely lacking, there is even more reason for the pooling of their knowledge and experience by the various parties concerned.

The Industrial Side

So much for the educational side of the picture—I now turn for a moment to the industrial side. Without the sympathy, understanding and practical assistance of industry itself, little real progress can be made in this all-important matter of training. The resources of educational authorities are very definitely limited—those of the industrial world are almost limitless. Much has already been done by firms in this country to stimulate and help both teacher and student. Facilities for works visits, vacation experience (sometimes with financial assistance) and studentships of considerable value have all been provided, although, with the exception of the first named, on all too small a scale.

Again, the teachers of chemical engineering will be the first to admit that the lectures and informal talks, which consulting engineers, plant manufacturers, and other business men so readily undertake to give at the various Colleges, are of the greatest possible value in providing the student and the teacher himself, not only with specialised knowledge of plant design, methods of fabrication and process details, but at the same time with an insight into those operational and economic factors which are not to be found in text-books or technical journals.

One must not overlook in this connection various Government and industrial

research organisations, the directors and staffs of which are no less willing to aid and support the teacher in similar ways. Admittedly, such contributions are by no means confined to the sphere of chemical engineering, but the impression gained is that in this subject more perhaps than in any other they are regarded as an indispensable part of College training.

This matter has been touched upon in the Report of the Chemistry Education Advisory Board which was published in January of this year, where reference is made to the desirability of a system of interchange between research workers and teachers in Universities and the staffs of industrial and Government establishments. Such a scheme is by no means so impracticable as might be thought, and the benefits obtained would, I am sure, far outweigh the difficulties experienced in putting it into effect.

It is to be hoped, too, that with the return of more normal times, those who are able to do so will endow or help to endow the much-needed chairs of chemical engineering which shortage of the necessary funds precludes the universities themselves from creating. It is equally to be wished that funds will also be made available for new laboratories, and, what is of equal importance (although often overlooked) funds for the maintenance and equipping of these.

State aid is also necessary in this subject as in others, and we trust that those charged with the duties of recommending and allocating Government funds for educational purposes will appreciate the claim of our schools of chemical engineering. It is satisfactory to be able to report the recent provision by the Board of Education of state bursaries for students in this subject. The award of these bursaries is regarded at present as a war-time measure only; they are very limited in number, and their application is restricted to post-graduate students. It is hoped that these limitations and restrictions will be speedily removed and that with the coming of Peace there will be, not a termination, but an extension of these much needed facilities.

The Institution Luncheon

Mr. F. A. Greene took the chair at the luncheon of the Institution which followed the annual meeting and presidential address. After the loyal toasts, the president proposed the health of His Majesty's Minis-

ters, coupled with the name of Col. Llewellyn, Minister of Food.

Col. Llewellyn spoke of the services of chemical engineers in the realm of refrigeration of foodstuffs. Much more could be done after the war in this direction, he said, and he envisaged a time when every house had its refrigerator. There would be more refrigerated ships, railway wagons and lorries. He also mentioned the chemical engineers' work on dehydration, with the immense saving of shipping space it made possible. The first dehydration factory in this country was started in June, 1943, and a debt was due to chemical engineers for planning and equipping such factories. Chemical engineers also played a great part in connection with the refining of sugar, fish oil, vitamin production and soap-making; they were also responsible for brewing and distilling. He concluded by thanking chemical engineers for all their help in food production.

Among those present at the luncheon were: Sir Stanley Angwin, Mr. F. W. Bain, Mr. Horatio Ballantyne, Mr. J. G. Bennett, Sir A. Vyvyan Board, Mr. T. F. A. Board, Dr. W. T. K. Braunholtz, Major-General G. Brunskill, Dr. R. T. Colgate, Mr. H. W. Cremer, Dr. W. Cullen, Mr. M. B. Donald, Sir Jack Drummond, Sir Alfred Egerton, Dr. H. J. T. Ellingham, Professor A. Findlay, Sir J. J. Fox, Dr. G. E. Foxwell, Mr. C. S. Garland, Professor F. H. Garner, Sir Alexander Gibb, Mr. G. Colman Green, Mr. Hugh Griffiths, Sir Patrick Hannon, Mr. Geoffrey Heyworth, Professor B. W. Holman, Mr. J. Allen Howe, Dr. P. C. C. Isherwood, Dr. L. A. Jordan, Dr. L. H. Lampitt, Dr. R. Lessing, Dr. H. Levinstein, Dr. G. Lewi, Sir Charles McLaren, Mr. B. G. McLellan, Sir George Nelson, Professor D. M. Newitt, Professor R. G. W. Norrish, The Hon. S. M. Lanigan O'Keeffe, Sir William Palmer, Mr. W. C. Peck, Mr. R. B. Pilcher, Mr. H. V. Potter, Mr. J. Davidson Pratt, Engr. Vice-Adm. Sir George Preece, Lord Rayleigh, Mr. Brian N. Reavell, Mr. J. Arthur Reavell, Mr. F. Heron Rogers, Mr. J. F. Ronca, Sir Leopold Savile, Air Marshal R. S. Sorley, Mr. H. Talbot, Sir Frank Tribe, Mr. S. J. Tungay, Dr. A. J. V. Underwood, Mr. W. T. Harmer Vizer, and Mr. C. B. Woodley.

After the luncheon, Mr. J. G. Bennett, director of the British Coal Utilisation Research Association, gave the first J. Arthur Reavell lecture, on the subject of "Coal and Chemical Industry." A thought-provoking speech, containing some very interesting and well-argued points, it provided an auspicious start for this new series of lectures that Mr. Reavell has endowed. Extracts from this address will be published in THE CHEMICAL AGE at the earliest opportunity.

On Precision Viscometry

A Consideration of Sources of Error

by L. A. STEINER

UNTIL recently accuracy in viscosity measurement was assumed to be only of scientific interest. However, the application of viscometry to analysis increased the demand for accurate viscometers, and for some of the applications an accuracy is being required which approaches the exactitude of viscosity standards themselves. There are not many pure compounds of which the viscosity is reliably known within narrow limits, and the choice is practically limited to water, sucrose solutions¹ and aniline.² Two of the applications of precision viscometry will be mentioned here: the determination of molecular weight of complex organic compounds, and the classification of mineral oils by "viscosity index."

In the first of these the viscosity of a solution of the material under test in an appropriate solvent is measured, and the increase in viscosity of the solution against the viscosity of the solvent is assumed to be a measure of molecular weight. A vast amount of work has already been done on the theory of the method and on some of the sources of error, such as discrepancies due to the influence of concentration, nature and purity of solvent, and temperature of test. Little has been done to investigate the errors due to imperfections of the viscometer used and it has been, unfortunately, seldom realised that the usual ratio of efflux time of solution to efflux time of solvent is not necessarily the ratio of the true viscosities and that, consequently, instrument errors and errors of procedure may easily lead to faulty results.

Classifying Oils

In the classification of mineral oils, viscosity measurement is being applied as an indication of composition. The real composition of a quite normal lubricating oil is known only in general terms, and technologists are naturally interested to know whether a given mineral oil is of the "naphthenic" or "paraffinic" type and, if a mixture—as it usually is—how much of each type is contained in the sample. Now the viscosity-temperature curve of a given compound is a very definite curve, a sort of fingerprint. The viscosity itself is *not* characteristic of a given material, but its viscosity-temperature curve is: for whereas syrup, glycerine, lacquer, or oil may have identical viscosities at a certain temperature, they will differ in that respect at other temperatures. This difference can be used to identify the material quite definitely, once the viscosity-temperature curves of the suspected materials are indexed. Impuri-

ties or adulteration with otherwise similar material (of waxes, for instance) may be detected and quantitatively determined by viscosity measurements.

In the case of mineral oils the problem is difficult in so far as the constituents of lubricating oils have not yet been isolated; consequently, there are no pure primary compounds from which to make mixtures that would be identical with actual mineral oils. Dean and Davis³ overcame the difficulty by choosing, arbitrarily, two sets of oils of different origin—one set representing the paraffinic type, the other the naphthenic one—indexing the first 100, the second 0, and determining the viscosity of each set at 100°F. and 210°F. With this information at hand it is possible to determine the composition of any unknown oil in terms of the oils indexed 100 and 0 respectively. The system was subsequently adopted as a standard by the American Society for Testing Materials and by the Institute of Petroleum.

The accurate determination of the viscosity index of a mineral oil requires a higher degree of precision than is otherwise usual in the petroleum laboratory, a fact which has led to lively controversy.⁴ While a comparatively rough estimate of viscosity may be satisfactory if it is to decide whether an oil is suitable for a certain machine or parts of it working at a definite temperature (and in most cases error of the order of ± 5 per cent. does not make any difference), the problem is quite different if viscosity is used as an aid to indicate the constituents of a mineral oil, and in this case an accuracy of at least ± 0.5 per cent. is probably essential. In the first instance, the analyst need not bother very much about the errors which are due to the instrument used; in the second, the analyst must be fully acquainted with the sources of error of the procedure and must use only instruments of utmost precision.

Capillary Viscometers

The application of viscometry to analysis is not limited to the above examples, and a discussion of possible errors due to the instrument used may be of some general interest. Five types of viscometer tube were described in a previous issue of this journal,⁵ including the most popular types in England, U.S.A., and Europe; each of them has some advantages and none is free from some type of error.

Steiner has directed attention⁶ to a particular type of error which has, apparently, not been considered before, i.e., that the calibration constant can on occasion vary

with efflux time. The calibration constant of a viscometer of the capillary type (say, a U-tube viscometer as per B.S.S. 188/1937) is, according to official procedure, determined at one point only, by measuring the efflux time of a standard liquid, the official kinetic energy correction being applied when necessary. It is assumed that the figure so acquired is a constant for the whole range of the instrument, its numerical value being dependent on the actual dimensions of the instrument. The dimensions of the instrument are constant, and the assumption of the constancy of calibration factor appeared so self-evident that no verification in detail seemed necessary. Of course, so long as a medium degree of accuracy sufficed, there was no need to make a more detailed examination, and the discovery of variations in the assumed constant is really due to the search for instruments of more than customary precision.

Kinetic Energy Correction

There was always some uncertainty as to the correct value of the kinetic energy correction and to the effect of incomplete drainage. To eliminate these influences Steiner has used two viscometers for which kinetic energy correction and drainage errors, if any, are identical, i.e., viscometers of the same type and size. These experiments have shown that two viscometers of the same range and type may exhibit errors which vary with efflux time. On the other hand, two viscometers of the same range but different type may be consistent within very narrow limits.⁷ For instance, the error curve of a No. 3 U-tube made according to B.S.S. 188/1937 and officially certified as such, in comparison with another tube of similar range, has shown at 300 seconds 0.3 per cent. larger error than at 100 and 800 seconds. The reproducibility of both tubes was very good, and it appears more appropriate to speak of a calibration curve than of a calibration constant.

An example of a case of very good agreement is a comparison of two viscometers of different type which have shown smaller discrepancies in the whole of their range than the accuracy of the procedure, which was in this instance of the order of ± 0.02 per cent.

The reason for this unexpected behaviour of capillary viscometers is not yet established, but Barr⁸ believes that his own measurements, conducted earlier and for other purposes, confirm the findings of Steiner. The data of Barr have not yet been published in full, and it may well be that priority for the discovery really belongs to Barr. The data concern two sets of viscometers, of the B.S.I. pattern size 2 and size 3, examined for the purpose of international standardisation and distributed to several

countries. The viscometers were compared at two points, and Barr quotes as worst figures a discrepancy of 0.5 per cent. in the case of No. 3 viscometers when the efflux time changed from 160 to 480 seconds, and about 0.2 per cent. in the case of No. 2 viscometer when the efflux time changed from 110 to 910 seconds. In view of the distribution of the viscometers to laboratories and authorities abroad it may be assumed that they were made with greatest care, and that viscometer tubes made for normal requirements probably exhibit larger discrepancies than those used for the purpose of international standardisation.

The accurate determination of the calibration constant, or of a calibration curve, is sometimes obstructed by an altogether different type of error. Some tubes do not give a good enough reproducibility, and no fixed value can be ascribed to the calibration constant when tested at a definite viscosity. Although no defects on the surface of the capillary or joints or bulbs can be detected by visual examination, some tubes do exhibit an erratic behaviour which makes an accurate determination impossible. It is, of course, always possible that impurities and personal errors reduce the accuracy of a calibration, but there is one case on record where a tube failed to give consistent results after the test had been repeated 13 times,⁹ the difference between maximum and minimum readings being about 0.75 per cent., although other tests made in between by the same personnel with viscometer tubes of the same type did give satisfactory accuracy.

Variations in calibration constant with efflux time are therefore conclusive only if discrepancies are determined at several points of the range of the tube and are, in addition, reproduced with a high degree of accuracy.

Elimination of Errors

The real reasons for both types of discrepancy (i.e., scale error and erratic behaviour) are not yet fully understood, and any view expressed at present is merely an opinion with no conclusive evidence to prove it. There is, however, a simple and effective method available for the elimination of defective instruments and losses in time and material, and that is a flow test at two or till better at three velocities in the half-finished viscometer, so that only such instruments are finished and subsequently calibrated which have shown freedom from erratic behaviour and which have exhibited no tendency to a wandering of calibration constant beyond a certain limit. Flow tests in an unfinished instrument give, naturally, only relative figures, but they are a welcome aid to predicting the probable behaviour of a particular viscometer tube.

There are few data available as to the accuracy to which calibration constants may be regarded as reliable if determined by two independent laboratories. The author has produced and calibrated six U-tubes of the B.S.I. pattern and submitted the viscometers, together with his figures, to the National Physical Laboratory. The following table shows the calibration constants in centistokes/second:

	Steiner	N.P.L.	Difference per cent.
1	0.05922	0.05914	0.14
2	0.04081	0.04087	0.15
3	0.2480	0.2470	0.40
4	0.2546	0.2548	0.08
5	1.615	1.613	0.00
6	1.720	1.720	0.00

Average + 0.10%

A typical example of a calibration curve (as distinct from a calibration constant) is represented in Fig. 1, which relates to a suspended-level viscometer constructed and calibrated by the author in accordance with Specification D445-42T of the American Society for Testing Materials. The factor (in centistokes/second) is plotted against log. viscosity (in centistokes) at quite close intervals. The viscosities cover a range from about 3 to about 250 centistokes. Each vertical division of the graph represents 0.14 per cent., and it can easily be seen that the curve fits all available data within about 0.05 per cent. A curve of the form of

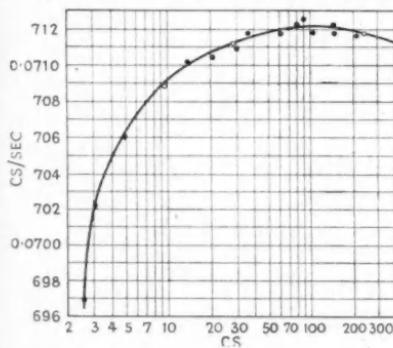


Fig. 1. Calibration curve of a capillary viscometer.

Fig. 1 cannot be expressed by the official formula $V = At - B/t$, where V is viscosity, A calibration constant, B another constant supposed to be 2.8, and t efflux time. Within a small range the formula is applicable, if a value of about 6 is assigned to B ; nevertheless, the useful range of the formula is limited, and a graph is more accurate though less convenient.

The high degree of precision in the viscometer tube itself is of little value if not

supplemented, in actual use, by accurate temperature control and accurate timing. Viscous liquids are, as is well known, exceedingly sensitive to temperature variations. For instance, a comparatively dilute solution of gun-cotton will have a 50 per cent. higher viscosity at 20°C. than at 25°C., and a molasses may easily change its viscosity by 100 per cent. for the same temperature change. Constant-temperature baths working with an accuracy of $\pm 0.01^\circ\text{C}$. up to 100°C . are now commercially available.

The introduction of electronic control gear with variable heat control did much

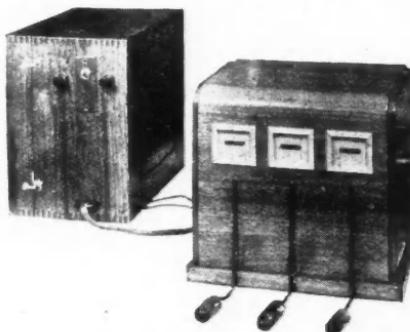


Fig. 2. Timing device.

to improve the performance of constant-temperature equipment. There is a twofold advantage in control gear of this type: firstly, the current which the regulator has to carry is reduced to about a thousandth part of the current which is necessary for a hot-wire or electro-magnetic relay; secondly, the heat input can be adjusted to balance the heat requirement of the bath exactly and without loss. The cumbersome and wasteful use of resistances is fully eliminated.

The most usual timing device is the spring-driven stop-watch. Its obvious disadvantage is its fragility and inaccuracy. The speed of a stop-watch is a function of the driving power of the spring and diminishes as the period to be timed lengthens. The error of a stop-watch is not the same at short intervals as at long ones, and the usual check against an accurate timepiece for, say, 1 hour is no indication of the error which prevails at, say, 100 seconds. The problem is still more difficult if a number of viscosities have to be run simultaneously, because of the inherent differences between individual stop-watches.

Time recorders which depend on the frequency of the mains supply are still less reliable. Mains-driven clocks are sufficiently accurate only for general purposes;

for short periods errors up to 1 per cent. may be encountered.

Recent developments in radio technique supply, however, a means of solving the problem, and a new timing device, described by the author,¹ has a constancy of frequency of 0.02 per cent., and is capable of driving as many recorders as are required. Fig. 2 represents on the left the master timer, which is a self-contained unit, and mains-operated. Variations of mains voltage and frequency have no influence on the accuracy of output which is led to the recorders. These are started and stopped by switches and indicate elapsed time intervals by figures, each figure representing 0.2 seconds. This electronic timer is particularly suitable where a large number of tests have to be carried out, and where consistency of time measurement is essential.

Rolling-Sphere Viscometer

The principle of the rolling-sphere viscometer is quite simple and can be seen in Fig. 3; a sphere rolls along a slanted tube, and the time is taken for the sphere to pass two marks. The relation between time and viscosity is expressed by the formula

Fig. 3.



$\eta = k \cdot t (d_1 - d_2)$, in which η is the dynamic viscosity in centipoises, k the calibration constant, t the time in seconds, d_1 the density of the sphere, and d_2 the density of the liquid under test.

A rolling-sphere viscometer by no means serves as a replacement for capillary viscometers (which express viscosity in centistokes), but there are a number of advantages to be gained by the use of the rolling-sphere method; for instance, very dark liquids can be measured just as well as transparent ones. Fig. 4 shows a complete instrument, particularly suitable for taking continuous viscosity-temperature curves. The quantity of liquid required is only 6 ml., and a number of spheres may be used simultaneously. The viscosity range of a sphere is about equal to the viscosity range of a capillary tube, and four spheres may easily cover

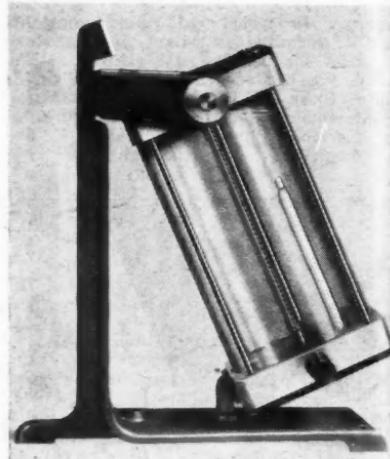


Fig. 4. Steiner rolling-sphere viscometer.

a range from, say, 0.6 to 10,000 centipoises. The viscometer is easily cleaned and can be equally well employed for the measurement of oils or of waxes, tar, rubber solutions, insulating materials, molasses, blood, etc. The substantial accuracy of the Steiner rolling-sphere viscometer has been demonstrated on aniline,² in which instance the analysis of error due to the instrument averaged ± 0.1 per cent.

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I.C.I. AIDS STUDENTS

The Maltese Government has accepted an offer by I.C.I., Ltd., to send two Maltese students to Canada to receive training in agriculture at the Guelph Agricultural College, Ontario. I.C.I. has also made an offer to the Chinese Government to bring home six post-graduate students for a scientific training at British universities. These students would be given the opportunity, during their long vacations, of acquiring experience in factory practice.

PENICILLIN PRODUCTION

In the House of Commons last week, Major Lyons asked the Minister of Supply if he would state the firms now engaged on the manufacture of penicillin; whether any, and which, firms were engaged substantially wholly thereon; and whether any licence was necessary for such manufacture. Sir A. Duncan, replying, stated that no licence was necessary; and he would communicate with Major Lyons about the other parts of the question.

Speed of Chemical Reactions

Measurement by Dundas Microtimer

THE Microtimer made by R. K. Dundas, Ltd., of Portsmouth, is—as its name suggests—an instrument intended for the convenient and accurate measurement of short intervals of time ranging from one millisecond to one second. While its greatest use lies in the development and testing of relays, contact breakers, fuses, stroboscopes, cameras, shutter releases, and all kinds of automatic machinery, it has other applications as, for instance, in measuring viscosity, high accelerations and velocities, and the speed of chemical (especially explosive) reactions. The instrument is suitable for operation by unskilled personnel.

The principle is that a large capacitance condenser which has previously been charged by a high voltage D.C. supply, is discharged, during the time interval which it is proposed to measure, through a constant current circuit into a selected high-stability precision condenser. The voltage developed across this second condenser is a function of the time during which the constant current flowed, and is indicated by a D.C. valve voltmeter of exceptionally high input resistance, stabilised by the introduction of heavy negative feedback. Two diodes are included—one to bypass the current which charges or leaks through the large condenser which later becomes the source of power for the discharging current, and the second to prevent the charge introduced into the precision timing condenser from leaking out after the interval to be measured has passed.

The standard model is controlled by the making or breaking of two pairs of external electrical contacts; any of the four combinations of makes and breaks can be used. It can also be operated directly without contacts by a photo-cell and valve amplifier. Six ranges with maxima of 10, 20, 100, 200, 500 and 1000 milliseconds are provided, and in all cases accuracy is within ± 1 per

cent. of full scale. Time intervals are read directly on the four-inch long meter scale which is calibrated in milliseconds. Special circuits ensure an almost complete absence of zero drift; the stabilising system protects



the accuracy of the instrument against any normal change of valve parameters or mains-supply voltage. The instrument is entirely self-contained, normally includes no batteries, and may be connected to any A.C. mains supply; a battery-driven model, however, is available. The meter scale can be supplied with other calibrations (e.g., feet per second, relative viscosity) when required for one special purpose.

ACTIVATED ALUMINA

A useful article on activated alumina as a drying adsorbent (readers will remember the recent contribution on this subject by Mr. J. Harwood and Dr. W. Cule Davies, in THE CHEMICAL AGE of March 4) appears in *Ind. Eng. Chem.*, Feb., 1944, p. 99. It is stated that the maximum dry gas capacity is attained by activation at 700-750° F.; this treatment reduces the volatile matter content of the bauxite, the raw material for alumina preparation, from about 28.30 to 6.8 per cent. Under optimum conditions bauxite will adsorb 11.16 per cent. by weight of water before any moisture is detectable in the effluent.

Temperature Measurement and Control

Thermo-electric Indicators : Thermocouples

THE war years have increased the great reliance which industry places upon accurate measurement and control of temperature. Without thermo-electric indicators process control must inevitably be sketchy and difficult; such instruments are virtually necessities when dealing with furnaces, annealing plant, molten metal, plastic mouldings, flue gases, salt baths, drying ovens, refrigeration, and so on. Specialists in this field are the Nottingham Thermometer Co., Ltd.

In these various types of thermocouple the construction varies according to the operation in question, temperature, and type of plant. The thermocouple elements

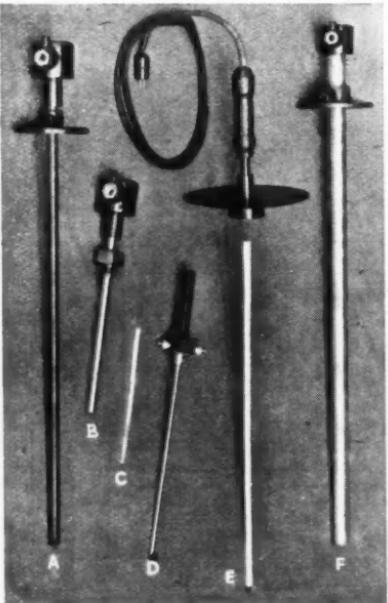


Fig. 1. Six types of thermocouple.

are either of base metal or rare metal, depending on the temperature attained. Special protection is provided against the corrosive action of gases, liquids, etc.

A number of thermocouples are shown in Figure 1. Instruments A-F are made in various lengths for use in furnaces, brick kilns, etc.; right-angle patterns of these are available for tempering and salt baths. Fitted with either base metal or rare metal elements, they can be provided with special refractory or alloy sheaths to meet different

working conditions. A special curved pattern shown in Figure 2, accompanying, is also made for use with liquid steel; this operates up to 1800°C., with an indicator

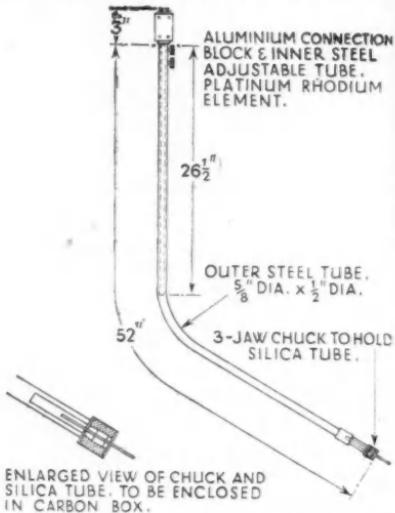


Fig. 2. Thermocouple for liquid-steel temperatures.

calibrated accordingly. B is similar to A, but is designed for use in pipe lines, or in any position where a screwed pattern can be fitted: the length of this thermocouple is generally up to 12 in. long. C is a strip thermocouple, for use with a suitable holder, and is designed for taking temperatures of rollers, but many different shapes can be made to meet various applications; this type of instrument is used for taking the temperature of steel plates, moulding press platens, engines, sparking plugs, and gear boxes of aero engines, etc. D, a laboratory pattern, is intended for use with small furnaces, or in positions which do not allow room for a bigger thermocouple. The portable hand pattern, E, designed for use in molten metal, is generally used for casting and die-casting work. The thermocouples pictured are in general everyday demand, but the firm makes many other types to suit special jobs which are too numerous to mention.

The same firm makes many kinds of thermo-electric indicators. For example, it markets portable types, wall types, and panel mounting single point indicators, as well as multi-point indicators. The last-mentioned

category provides temperature control of up to 12 points. Fig. 3 (right) shows a 12-point instrument, operated by push-button mercury switches; this makes it possible to take temperature readings at any of 12 points by means of a single indicator. These thermo-electric indicators are suitable for all ranges up to 1400°C.

Constant-Temperature Baths

The new National Milk Scheme, which aims at improving the general standard of cleanliness of milk sold in this country, depends on tests carried out at fixed temperatures. For this kind of work the constant-temperature baths marketed by the Nottingham Thermometer Company, Ltd., are eminently suitable. These baths can be supplied in copper or stainless steel. There are two sizes, to hold 40 and 100 tubes respectively, and both types can be heated by either gas or electricity. They are fitted with copper racks, each of which holds 10 test tubes. (The 100-tube bath can be fitted with two racks holding 50 tubes apiece, and such racks are particularly useful for platform use.) All the racks, which are removable, are numbered and lettered, so that a separate record can be kept of every test tube placed in the bath. The temperature is automatically controlled to $\pm 1^\circ\text{C}$. by means of switch and thermostat. Baths can be supplied for control to that degree of accuracy for the following tem-

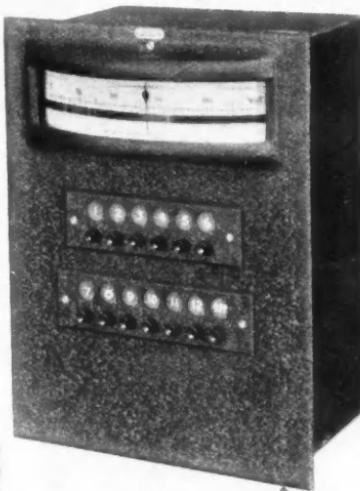


Fig. 3. Totally-enclosed thermo-electric indicator

peratures: 15—18°C., 37.5°C., 63°C., 49.50°C. Soil bacteriology is another field in which these baths find application.

Towers Streamline Hydrometers

New Balance and Pump Projected

RECENT catalogues published by J. W. Towers & Co., Ltd., of Widnes, Manchester and Liverpool, give details of their graduated glassware and streamline hydrometers. Appreciating the need for dependability in laboratory apparatus, all items are of guaranteed accuracy. Towers streamline hydrometers are now made from Normal glass tubing, which is a glass specially prepared for the manufacture of thermometers and hydrometers. After being annealed these instruments are given a severe test by immersion in boiling water, followed by plunging into cold water. The streamline pattern is less liable to breakage, comes to rest sooner, and is more easily cleaned than the old type. Thermo-hydrometers have recently been added to the wide range already made.

The Towers analytical balances, Models 55 and 75, are being produced in increasing quantities, and are helping to meet the present large demand. Analytical weights have been added to this firm's products. They are made in nickel-plated and gold-plated finish, and are guaranteed to N.P.L. Class A or Class B tolerances of accuracy. A works certificate is supplied with all "A"

Quality sets. A sliding weight balance (similar to the Trip pattern) for rough weighing up to 1 or 2 kg., with a weight range of 200 gms. to 1/10th gm., is in course of production and it is hoped to market it shortly.

Several items of rather specialised apparatus are also in course of production. One of these is a high vacuum pumping unit incorporating a quartz three-stage mercury vapour pump, a double McLeod gauge, cooling and drying traps, and the necessary high vacuum stopcocks. Others are a micro-hydrogenation apparatus and a fractional distillation apparatus with reflux-ratio head. Fenske helices for packing fractionating columns are now available, and are of particular interest to the petroleum chemist.

Other well-known items made by this firm are electric ovens, furnaces, incubators, pure acids, analytical reagents and Dreadnought glass pipelines.

The production of acetone and acetic acid has been started, it is reported, by the Unión Española de Explosivos at Guardo, near Valencia, Spain.

On the Food Front

New Application of Pulsometer Pumps

ALL centrifugal pumps work on the same principle, yet the variation in design to meet special requirements is almost endless. The aim of the Pulsometer Engineering Company, of Reading, who have specialised in the making of pumps for nearly three-quarters of a century, has always been to cater for special requirements. From their long experience of pumping problems, they can generally offer a pump exactly to suit any demand.

War has given added importance to food. National morale and health demand that its quality should be high and as concentrated as possible, transport problems requiring its reduction in bulk. New processes of manufacture and treatment, therefore, are constantly arising; among these is the dehydration of meat and vegetables, which, by conserving food values and reducing food bulk, is an invaluable aid to all the fighting Services. In many of the new food processes "Pulsometer" pumps play their part—often in ways not visualised when they were first designed. "Pulsometer" vacuum and stoneware and special metal types are constantly used in food technology, but Fullway pumps have only recently been pressed into service on the food front. These Fullway pumps, designed for pumping liquids containing solids, have large passages throughout that will pass spheres of any size up to the internal diameter of the suction branch; they are made in sizes up to and including 10 in. They can be made to work in either a vertical or horizontal position. The curved impeller entry permits solids to pass through with comparative ease; the impeller is made with two or three passages for solid matter, and the ample dimensions of the casing allow for any sphere that will pass through the impeller.

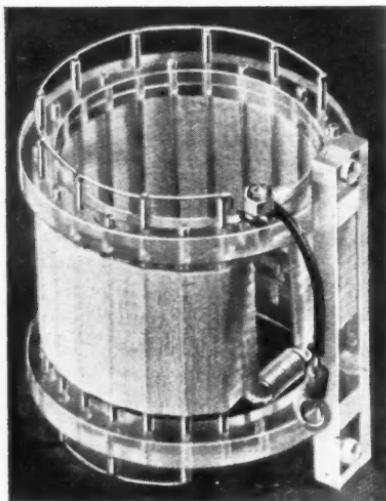
Recently, twelve "Pulsometer" Fullway pumps and four end-suction centrifugal pumps were delivered to four Government potato factories. The twelve Fullway pumps have been installed in four batteries of three pumps—one battery at each of the four factories, working under different heads—two of the three pumps in each battery for constant work. Of these, one is assigned for use in connection with flumes (artificial channels conveying water for industrial use) and the other for settling-tank duties. Each Fullway pump has a central suction branch, and is capable of delivering 500 gals. per minute against a total head from all causes of 60 feet when running at 950 r.p.m.; absorbing 16½ b.h.p., it requires a 20 b.h.p. motor.

The pump casing, cover and impeller are of cast iron, the impeller and all passages being specially designed to prevent the

catching of fibrous matter. The spindle, of high-grade steel, is supported in ball and roller bearings mounted in the pump hood and arranged to reduce the overhanging weight of the impeller to a minimum.

A New Hygrometer Direct Measurement of R.H.

A N addition to the wide range of indicators, recorders and controllers of temperature, pressure, humidity and liquid level made by the firm of Negretti & Zambra, 122 Regent Street, London, W.1, is the patented Gregory Indicating or Recording Humidiometer, based upon an entirely new principle which has been tested in actual practice and found to give excellent results. It comprises a piece of textile material impregnated with calcium chloride interposed between electrodes connected in an electrical circuit that enables the elec-



The Gregory Humidiometer.

trical resistance between the electrodes to be measured. This resistance varies in accordance with the quantity of water vapour absorbed by the material, and is measured by a micro-ammeter or recorder.

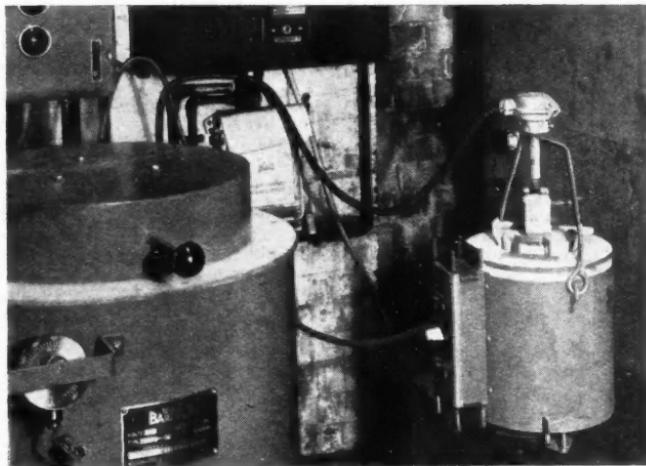
The scale may record from 40-80 per cent., 20-100 per cent., or over any other range of humidity, and the device is capable of operating effectively over a wide temperature range. Various forms of container are provided for the hygroscopic element, depending upon the purpose for which the apparatus is required. Extreme sensitivity and high accuracy are the main claims for this new instrument.

A Useful Portable Furnace

Pyrometer Tests on Site

THE accompanying illustration shows a new portable type of furnace, produced by Wild-Barfield Electric Furnaces, Ltd., for pyrometer tests on site. This furnace

grooved refractories which support a spiral coil of relatively heavy gauge nickel-chromium alloy. The chamber is 4 in. in diameter and 8 in. deep, and the maximum



Portable testing furnace (right) adjacent to a vertical forced-air-circulation furnace and a potentiometric non-indicating controller.

was designed for the rapid tests of thermocouples on site and adjacent to the furnace in which the thermocouple was employed, utilising known characteristics of certain elements such as the freezing point of tin, lead, aluminium, zinc, and sodium chloride. The equipment is quite small and comprises a light steel case with lifting handle and with a chamber formed by internally

loading is 1.5 kW. Interchangeable metallised steel melting-pots are provided with internal dimensions of 2½ in. diameter and 6 in. deep to contain one of the elements mentioned above. The equipment is supplied complete with a length of 3-core cable terminating in a standard plug ready for connection to any standard low voltage single phase supply.

Canadian Resources Board

Industries of New Brunswick

To encourage the development of new industries within the province, a Resources Development Board has been set up for New Brunswick, Canada. Its first work will be concerned with forest products. Chairman of the board, Dr. Harry J. Rowley, who will be giving full-time service to his new position, is attached to Allied War Supplies, Montreal. Other members are Dr. John S. Bates, Mr. G. Percy Burchill, Lieut.-Col. W. A. Harrison and Mr. R. B. Brown. Dr. Bates, local manager of Price & Pierce, Ltd., transferred to the British branch of his firm when war was declared, returning to Canada in 1940.

S.C.I. Engineering Group

Vacancies on the Committee

NOMINATIONS for four new members to fill vacancies on the committee of the Chemical Engineering Group of the S.C.I. should reach the offices of the Group by April 28. Nominations must be signed by not less than three members of the Group, and no member may sign more than one nomination. The members to retire from the committee this year are: Mr. C. W. James, Mr. A. Sanders, Dr. A. J. V. Underwood, and Major R. J. Venn, none of whom is eligible for re-election during the ensuing year. The annual meeting and luncheon will be held on May 10, at the Waldorf Hotel, London, W.C.2.

Glass-Lined Equipment

Favourable Conditions of Use and the Reverse

THE conditions under which glass-lined equipment may or may not give complete satisfaction are becoming an important matter of study and classification, as the use of such equipment grows progressively broader with the development of new products in the chemical industries.

Glass-lined vessels are used with complete satisfaction in the handling of all mineral and inorganic acids, including hydrochloric acid, wet chlorine, and other acids of the halogen group except hydrofluoric, under concentrations and at temperatures up to 345°C., according to the size of the piece. The design of the piece, the pressure conditions, and other possible factors may change the gallonage rating. The limits of capacity and pressure are rather difficult to define exactly, but the following is given as a guide:

	Temp. °C.
Vessels up to 3000 gals. handling	
HCl at	120-150
Vessels up to 1500 gals. handling	
HCl at	230-260
Vessels up to 750 gals. handling	
HCl at	290-315
Vessels up to 100 gals. handling	
HCl at	315-345

In considering the service conditions it is to be noted that glass linings may have remarkably long life, and conditions of failure or relatively shorter life are sometimes identified either with additives which are not capable of being handled satisfactorily in glass, or with imperfect base material, namely, steel. Even with "specification steel," and in the face of the most rigid metallurgical testing, it is possible to use steel that does not afford an ideal base for the application of glasses. This risk, however, it is reported, is being progressively reduced.

Recorded Tests

To illustrate the point of the real resistivity of glasses, some tests are recorded in which cover-glasses, containing the usual mill additions, were formed into rectangular shapes of varied section and were subjected to the action of various acids for a definite period, and under the conditions outlined. The results were as follows:

A. Dilute lactic acid boiling for 720 hours: The loss of weight on the immersed sample of glass indicated by exact measurements that the approximate life of the glass would be 62.2 years.

B. Dilute phosphoric acid boiling for 720 hours: The loss of weight indicated an approximate life of 42.8 years.

C. Distilled water boiling for 720 hours:

The loss of weight indicated an approximate life of 244 years.

These figures may be considered startling when related to the practical results obtained with any type of corrosion-resistant equipment, but the examples given show that the glass itself possesses almost unlimited life in the presence of many acids.

Where Glass Fails

Consideration of the conditions under which glass-lined equipment fails to give completely satisfactory service provides a difficult question to answer. Broadly, it may be stated that glass-lined steel equipment and, in fact, any glass, is not satisfactory for handling caustics, particularly sodium and potassium hydroxide, and more so for the alkaline-earth alkalis; although small percentages of these alkalis involved in a high-velocity reaction might have little effect on the glass. However, to attempt to handle saturated solutions of any of these alkalis would mean that a progressive etching would occur and, again depending upon the conditions, would eventually result in removal of the glass from the steel by chemical action.

On the other hand, alkaline solutions to a pH of 10 at room temperature, and sometimes higher, have been handled with results that were not unsatisfactory to the user. In other words, a combination of required acid resistivity in the glass, along with a pH of, say, 9, necessitated the use of a piece which, practically speaking, was not available in any single material of construction. Hence, the glass-lined vessel turned out to be the most practical all-round unit. To avoid such combinations, however, it is desirable to conduct the acid reaction in one vessel if possible, and the alkaline reaction in another.

Under the heading of "unsatisfactory conditions" would come hydrofluoric acids and all the fluorides. Commercial phosphoric acid also, if it contains fluorides as an impurity, cannot be handled without some degree of chemical attack.

The Sumitomo Chemicals Company, a subsidiary of the Sumitomo combine, has, according to reports recently received in this country, expanded very considerably and is now one of Japan's leading chemical plants. The company entered the field of nitrate and sulphuric-acid production and is now concentrating its efforts on the production of aluminium. A close connection is stated to exist between this company and both the Nippon Senryo, Japan's leading dyestuff concern, and the Tokuyama Soda Company.

The Trend of War-Time Earnings

Analysis of Audited Accounts

by S. HOWARD WITHEY, F.C.I.

THE figure of £105,122 shown in the trading account submitted by the directors of Burt, Boulton & Haywood, Ltd., representing the gross earnings for the financial year ended June 30 last, compares favourably with £95,525 in 1941-42. After charging £14,389 for depreciation, £4863 for debenture interest, and £8138 for directors' fees, and reserving the sum of £47,500 for taxation, as against £40,922 previously, the balance of net profit is £30,232, representing an increase of £3800, and enabling the rate of dividend on the ordinary capital to be raised from 4 per cent. to 5 per cent. The company was registered in 1898, and specialises in the manufacture of chemicals and paints, and as tar distillers and timber merchants, the authorised capital being £720,000, of which a total of £669,790 has been issued. This consists of £150,000 in the form of 7 per cent. cumulative preference stock—the dividend on which is paid half-yearly in January and July—and £519,790 in ordinary stock. After meeting the dividends, there is a margin of £11,657, out of which £11,500 has been transferred to reserve, the forward balance being then increased by £157. The reserve funds cover war losses and investments, also debenture redemption, and now amount to £300,000, or 45 per cent. of the issued capital. The following is a summary of the final account covering the past year:—

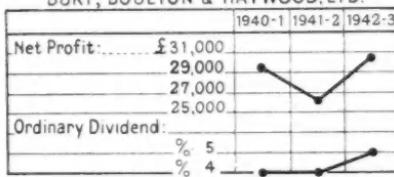
	£
Brought forward from 1941-42	18,794
Net profit : year ended June 30, 1943	30,232
Disposable balance	<u>£49,026</u>
7 per cent. dividend on £150,000 cum. pref. stock	£10,500
Less income tax at 10s. in the £	£5250 5250
5 per cent. dividend on £519,790 ordinary stock, less tax ...	13,325
Allocated to reserve ...	11,500
Carried forward to 1943-44	18,951
	<u>£49,026</u>

Subsidiary Concerns

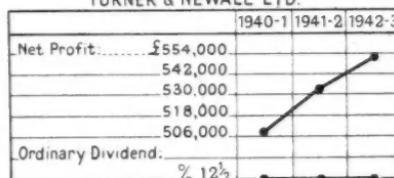
Investments in subsidiary, associated, and other trading concerns are shown on the balance sheet at £326,445, and the property and plant, etc., are valued at £342,140. The debtors at the close of the year amounted to £322,731, and the stock was valued at £106,534, the current assets totalling £652,618, giving a surplus of £438,296 over

the current liabilities. In 1942, the ordinary £1 stock units reached 18s. 3d., the lowest price during the year being 12s. 6d., but at the time of the last annual meeting the

BURT, BOULTON & HAYWOOD, LTD.



TURNER & NEWALL LTD.



price had risen to 21s. Recently they were quoted at 22s., on which basis the actual return is over 4½ per cent., and at 27s. the preference £1 units yield 5.2 per cent.

Turner & Newall

The accounts of Turner & Newall, Ltd., the great asbestos combine and manufacturers of magnesia, cork insulation, pharmaceutical products, and linings for brakes and clutches, etc., are made up to the end of September, and during 1942-43 the gross earnings reached the new high record of £2,710,801. This figure compares with £2,407,550 in 1941-42, and £2,545,721 in 1940-41, and after debiting £199,211 for depreciation and providing £1,955,667 for taxation, the balance of net profit is £553,292. This represents an increase of £22,452 in relation to the previous year, and as the ordinary dividend is maintained at 12½ per cent. the forward balance is £21,017 higher. The company started in 1920 as a private concern, and was made public in 1925, the authorised capital being £7,250,000, of which a total of £6,777,672 ranks for dividends. This comprises £1,444,269 in the form of 7 per cent. cumulative preference stock—the dividend on which is paid half-yearly in June and December—and £5,333,403 in ordinary stock. As before, the reserve fund receives £100,000, and another grant of £10,000 has been made

to the pension fund, the final figures being balanced as follows:—

	£
Brought forward from 1941-42	78,441
Net profit: year ended September 30, 1943	553,292
Disposable balance	£631,733
Dividends	422,275
Transferred to reserve fund	100,000
Allocated to pension fund	10,000
Carried forward to 1943-44	99,458
	£631,733

Fixed assets are shown on the consolidated balance sheet at £5,011,427, this figure being arrived at after deducting reserves amounting to £5,918,795, while the floating assets total £13,506,622. In 1942, the ordinary £1 stock units reached 76s. 9d., the lowest price during the year being 62s. 6d., and recently they were quoted at 78s. 6d., giving a return of 3.2 per cent., which reflects the public confidence in the future of the organisation. At 36s. the preference £1 units yield 3.9 per cent.

A CHEMIST'S BOOKSHELF

THE ULTRA-FINE STRUCTURE OF COALS AND COKES. London: B.C.U.R.A. and H. K. Lewis & Co. Pp. 366. 25s.

Those who are looking forward to the development of great new industries based on coal as a chemical raw material feel that not nearly enough is known about the physical and chemical constitution of coal. The B.C.U.R.A. conference, whose proceedings are recorded in the present volume, was convened to discuss the physical nature of coal and gave rise to some 23 papers and a considerable discussion. The views expounded were somewhat divergent, as would be expected, but will be of great interest to research workers on the subject. In some respects one is led to the conclusion that the supposedly newer work on the subject is little more than a wider repetition of older work. Those who read carefully the paper by Dr. J. G. King and Dr. E. T. Wilkins may be pardoned if they come to the conclusion that it has all been done before. The work of Riley and others seems to have shown that there is an apparent continuity of layer-plane structure throughout the whole series of carbonaceous materials from peat to anthracite and to coke. The chemical structure of coal has been considered by coal chemists to be highly aromatised, whereas biochemists regard it as "a polymer condensation complex of substituted propyl benzene residues, the oxygen being ether-linked." Frankly, the constitution of the fundamental repeating units eludes us and we are

turning to physical investigations in an endeavour to obtain some elucidation of these difficulties. From observations on the heat of wetting it appears that coal has a very large internal surface; what the significance of this is we do not yet know, but it has been aptly said that if methyl alcohol can penetrate coal, so also can air. Space forbids us to enter into any detailed discussion of the chemical and physical structure of coals, but enough has been said to indicate the magnitude of the task of determining the true nature of coal. So far these researches have had no practical application, unlike those made into the mechanism of coke formation, but with increasing knowledge, who can tell what new processes may suggest themselves?

"ANALAR" STANDARDS FOR LABORATORY CHEMICALS. 3rd Ed. London: British Drug Houses and Hopkin & Williams.

The guarantee of purity covered by the trade-mark "AnalaR" is known wherever laboratory chemicals are used, and it is supported by the high reputation of the firms that employ it. It is particularly useful, therefore, at this stage of the war, to have access to a descriptive list of the available chemicals bearing that standard brand. A study of the tables showing the maximum limits of impurities in each of the "AnalaR" chemicals should convince the reader that the amounts are so minute as to be neglected by the analyst for routine purposes. In preparing the third edition, many of the tests have been made more delicate or more definite, particularly that for iron; tests for impurities in the nickel salts have also been radically altered and improved.

In the present edition, eleven new monographs appear, *viz.*: ammonium dihydrogen phosphate, ammonium tartrate, cobalt oxide, ethyl acetate, hydrogen peroxide (100 vol.), magnesium acetate, nickel nitrate, perchloric acid (72 per cent.), potassium periodate, isopropyl alcohol, and sodium dihydrogen phosphate.

POST-GRADUATE LECTURES—PHYSICAL CHEMISTRY. By E. J. Bowen, M.A., F.R.S. London: Oil and Colour Chemists' Association. Pp. 32. 3s. 6d. post free.

The Oil and Colour Chemists' Association has published the three post-graduate lectures delivered by E. J. Bowen in July last year. They include a treatment of wave mechanics which Mr. Bowen has devised for the benefit of those whose mathematical standard falls short of what would be required to follow a fundamental exposition of the subject. The treatment has an important virtue in that it is as agreeable to study as it is to read cursorily. The same is true of the second lecture on the physical chemistry of fluorescence and phosphorescence; and of the third, a lecture on modern theories of reaction rates.

Personal Notes

The Chemical, Metallurgical and Mining Society of S. Africa, celebrating its jubilee at a meeting on March 24, sent a cablegram of greetings to DR. WILLIAM CULLEN, the senior past-president of this organisation.

MR. JOHN ALLAN, B.Sc., A.R.I.C., who has been principal teacher of science at Fraserburgh Academy since 1932, has been appointed headmaster of Bridge of Don School, Aberdeen.

At the annual meeting of the Edinburgh section of the S.C.I., PROFESSOR G. F. MARRIOTT was elected vice-chairman in place of DR. E. G. V. PERCIVAL who resigned. DR. W. M. AMES, DR. E. G. V. PERCIVAL, MR. W. T. DOW and MR. J. B. WESTWOOD were elected to vacant places on the committee.

MR. WALLACE P. COHOE recently completed a Canadian tour, during which he addressed three active sections of the Society of Chemical Industry in his capacity as president of that society. By these sections—Ottawa, Montreal and Toronto—he was welcomed, reports *Chemistry and Industry*, "not only as an old friend but also as a brilliant and interesting speaker of the first order."

As already announced in our last week's issue (p. 363), LORD EUSTACE PERCY has been appointed chairman of the departmental committee set up by the Board of Education to review the relation of universities to technical colleges in the field of higher technological education. The other members of the committee are: DR. R. S. ANDERSON, SIR LAWRENCE BRAGG, MR. W. H. S. CHANCE, SIR CHARLES DARWIN, DR. E. V. EVANS, MR. MOUAT JONES, MR. S. C. LAWS, DR. H. LOWERY, MR. H. S. MAGNAY, SIR GEORGE NELSON, MR. J. E. REES, DR. R. V. SOUTHWELL, and MR. H. FITZHERBERT WRIGHT.

Obituary

Distinguished foreign chemists whose deaths have recently been reported include M. PAUL BARY, the doyen of French colloid chemistry, who has died in Paris, aged 80; and DR. EMIL BAUR, Professor of Physical Chemistry at the Federal Technical High School, Zurich.

The death is reported of MR. ROBERT OWEN, B.Sc., A.R.C.S., D.I.C., who was killed, with his wife and their three-days' old baby, in an air raid. Graduating in 1931, at the Royal College of Science, where he held a Royal Scholarship, he joined the Lister Institute, and gained the McLeod research scholarship for biochemistry. Since 1935 he had been with J. Lyons & Co., Ltd. He became an A.R.I.C. in 1935.

New Control Orders

Containers

THE Control of Containers and Packaging (No. 1) (General) Order, 1944 (S.R. & O. 1944, No. 404), which came into force on April 18, revokes and consolidates the Control of Tins, Cans, Kegs, Drums and Packaging Pails (Nos. 5-10) Orders, 1940-43; the Control of Packaging (Nos. 1 and 3) Orders, 1942; and the Control of Metal Collapsible Tubes (No. 1) Order, 1942.

The Order regulates the manufacture of certain types and the marking of all types of container. It also regulates the packaging for distribution or disposal for the home trade of all articles and commodities listed in the Packaging Index Schedule issued by the British Standards Institution.

The principal changes in the new Order are: (a) the range of commodities, the packaging of which is regulated, has been extended; (b) the use of used containers and holders is more strictly regulated; (c) the use of certain container-sealers, such as rubber packaging rings, stoppers and bungs, foil-faced wads, etc., is now controlled; and (d) detailed modifications have been made to certain sections in the revised British Standard Schedules.

Association of Tar Distillers

Election of Officers

AT the annual general meeting on March 15 the following officers and executive committee were elected for the ensuing year:—President, Mr. C. E. Carey; vice-president, Mr. S. Billbrough; hon. treasurer, Captain C. W. Harriss; hon. auditor, Mr. E. Hardman. Executive committee: (Scotland), Mr. S. Hilton, Mr. J. Simpson; (N.E. Coast), Mr. J. Colligon, Mr. W. A. Walmsley; (N.W. Coast), Mr. C. Lord, Mr. C. A. Murray; (N. Midlands), Mr. S. Billbrough, Mr. A. Bradbury; (S. Midlands), Mr. R. B. Robinson, Mr. W. H. Phillips; (London and S.E. Counties), Mr. J. H. Olliver, Major A. G. Saunders; (S.W. Counties), Mr. H. H. Bates, Dr. T. H. Butler; (Wales), Sir Charles H. Bird, Mr. C. F. Dutton; (Small Distillers), Mr. E. Hardman; together with the president, the vice-president, and Col. W. A. Bristow, and Mr. Stanley Robinson (past-presidents). Owing to pressure on our space the annual report is held over until next week.

A caustic soda plant is reported to be in course of erection at Iguape, in the southernmost zone of the State of S. Paulo, Brazil, where it has been found that salt can be successfully produced by the salt-pan natural evaporation process.

General News

The staff of Boots Pure Drug Co., Ltd., aim to raise during Nottingham's "Salute the Soldier" Week the cost of upkeep of a base hospital for a year.

The aircraft specification, D.T.D. 498, for silicon-nickel-copper alloy bars and forgings, has been reprinted with the addition of Amendment List I and is published by H.M.S.O., price 1s.

The firm of M. F. Findlay & Co., explosive merchants, 19 Cadogan Street, Glasgow, of which the late Mr. Robert Thomson was the sole proprietor, has been dissolved as from March 31.

Specification D.T.D. 124A, covering hot-rolled or cold-rolled carbon steel sheets and strips (40 to 55 tons 0.1 per cent. proof stress), suitable for welding, supersedes D.T.D. 124, of November, 1936.

The Association of Scientific Workers has opened a Scottish office, the address of which is Room 257, 11 Bothwell Street, Glasgow, C.2. The address of the new Birmingham office is Unity Chambers, 262 Corporation Street.

The application of salt to sugar beet and mangolds, at the rate of 3.5 cwt. an acre, is recommended by the West Riding War Agricultural Executive Committee, 67 tests with 5 cwt. per acre giving on the average an extra ton of roots per acre.

A consolidating Order, embodying the entire current list of traders in neutral countries with whom dealings of any kind are illegal, has now been published. Its title is the Trading with the Enemy (Specified Persons) (Amendment) (No. 4) Order, 1944 (S.R. & O. 1944, No. 399) and its price is 4s.

Lennox Foundry Co., Ltd. has produced a leaflet, No. B 1344, dealing with Vis-Flo Sight Glass Fittings, now available in a range of standard sizes to suit any liquor whether acid, alkali or neutral. The standard type is supplied for pressures up to 50 lb./sq. in., but for higher pressures (up to 1000 lb./sq. in.) special fittings are available.

In the process of chromium plating small nodules of almost pure chromium are deposited in the vats and on the "suspenders" and "robbers" of the bath. At least one producer of chromium metal is interested in the commercial recovery of these metals, and chromium platers having an accumulation of nodules (however small), or able to offer them in regular parcels, should communicate with the salvaging company whose address can be obtained from the Ministry of Supply, Chrome Ore, Magnesite and Wolfram Control, Broadway Court, Broadway, Westminster, S.W.1.

From Week to Week

Coal output of Scotland is now 24,000,000 tons a year, as compared with 32,000,000 tons in 1936. These figures were given by Sir Patrick Dollan at a meeting of the North British Association of Gas Managers at which he urged greater efficiency and economy in the use of coal.

Applications of X-ray analysis to industrial problems were discussed by Mr. A. P. Rooksby in a recent lecture to the Royal Institute of Chemistry. He cited the conversion of anatase into rutile (the latter being the best form of titanium dioxide for paint pigments), the successor of which can be found by X-ray studies. A précis of the lecture appears in *Chemistry and Industry*, April 15, p. 149.

D.T.D. Specifications for aluminium-coated high-tensile aluminium sheets and coils (solution treated and artificially aged), aluminium alloy sheets and coils (solution treated) and brass tubes (suitable for low-pressure hydraulic systems) have been published by the Stationery Office, with the necessary amendments. The prices of these specifications—Nos. 546, 603 and 604 respectively—are 1d. 1d., and 1s. 6d.

A short-lived strike was reported at the Merseyside works of High-Speed Alloys, Ltd., on Wednesday last week, 50-60 employees being involved. It appears that the men belonged to a union which has no negotiating recognition with the firm, and they refused to work unless an interview was granted. Others, however, offered to take the place of the strikers, who resumed work on Thursday afternoon, the management refusing interviews with the leaders.

Research in Great Britain was the subject of an address by Professor Timmersmans, formerly a professor of chemistry in Brussels, at last Saturday's meeting of the Association of University Professors and Lecturers of Allied Countries in Great Britain. Among the aims of the association, which works in close collaboration with the British Association, is the reconstruction of the universities in the occupied countries after the war.

A paper-based plastic material has been used in the construction of a new type of luggage van now used by the Southern Railway. This new van weighs only four-fifths as much as vans of the type built previously, which weigh 13 tons. Use of this new material, which is claimed to be fireproof, represents a considerable saving in wood and steel which are in heavy demand elsewhere. This is just one more call on the paper supplies of the country, and one more reason why there must be no slackening off in paper salvage while our greatest tasks still lie ahead.

The Board of Trade index figure for the wholesale prices of industrial materials and manufacturers continue to increase steadily, the March figure being 168.0 compared with 167.4 for February (1930 = 100). Coal and metals were stationary, but chemicals and oils, at 151.6, showed a rise of 0.1 per cent. The reason for this rise is not officially stated.

A demonstration of the "Cheecol" process of concrete road-making was staged last week in Berwickshire. In this process the stone aggregate is first laid and shaped; then a grouting of cement, sand, water and a small quantity of "Cheecol"—a liquid which has the effect of making the grout plastic—is poured or pumped over the aggregate. The "pourability" of the mixture enables it to fill every void in the stone mass, producing a dense and waterproof concrete.

Foreign News

Representatives of German commercial interests in Portugal have been urgently summoned to a meeting in Lisbon this week. They include managers of tungsten mines in the north, and engineering and chemical agents from Oporto.

The International Sample Fair will be held in June this year in Barcelona, Spain. American firms are planning to exhibit there, and the U.S. Department of Commerce expects shipping space to be available for them to do so.

National Chemical Products, Ltd., of South Africa, has ceased producing glycerine from molasses by a fermentation process. The method yielded high-quality glycerine, suitable for making dynamite, but proved uneconomic.

A new phosphate deposit has been discovered in Switzerland in the district of L'Auberson (Neuchâtel). It is estimated that about 500,000 tons of superphosphate with 18 per cent. phosphoric acid could be produced.

Cement production in Venezuela amounts to 120,000 tons a year. A new cement company, with a capital of 9 million bolivares, has been started under the name of Compañía Anónima Venezolana de Cementos, and is erecting a plant at Portugalete.

Supplies of oiticica oil from Brazil have been so large that the United States is able to suspend restrictions on its use. This oil is being used as a substitute for tung oil for many purposes. Its main use is in the manufacture of varnishes and lacquers.

The fact that goods made of raw materials in short supply owing to war conditions are advertised in this paper should not be taken as an indication that they are necessarily available for export.

Synthetic motor fuel based on calcium carbide is being produced in Switzerland by the Lonza A.G. Known as "Para," the new fuel contains about 75 per cent. of paraldehyde, with suitable additions, e.g., methanol or its derivatives. The production capacity of the Lonza A.G. is 10,000 tons yearly.

A calcium carbide plant is being constructed at La Felguera, Asturias, Spain, by Productos Químicos Sintéticos S.A. The capacity of the new plant, which is to be equipped exclusively with machinery produced in Spain, is reported to be 6000 tons of carbide per annum.

Non-hygroscopic fertilisers are being developed in Germany, based on the mixture of blast furnace slag and ammonium nitrate solutions. According to *Chemical and Engineering News*, acid slag is used which does not need to be heated with sulphuric acid before mixing, and it is claimed that the process saves considerable quantities of lime.

Last year's lead production in the United States is estimated at 470,000 short tons of refined lead and 60,700 tons of antimonial lead, a decrease of 19 per cent. and an increase of 23 per cent. respectively. The percentage of antimony in antimonial lead continues to fall and this signifies the increased amounts of low percentage alloy used in the manufacture of products for military use.

Forthcoming Events

A meeting of the International Society of Leather Trades' Chemists, Manchester Group, has been arranged for April 22 at 1 p.m. in the Engineers' Club, Albert Square. Dr. Laurence Okell will talk on acids and salts in tanning liquors, and Mr. G. H. W. Humphreys will present a paper dealing with recent advances in leather manufacture.

The chemical exhibition arranged by the Association of Scientific Workers will be on show in Widnes from April 24 to April 29 at the Technical College.

The Institution of the Rubber Industry, Manchester Section, meets on April 24, at 6.15 p.m., at the Engineers' Club, Albert Square, for its 20th annual general meeting, which will be followed by the film "Rubber in the Rouge."

The next meeting of the Electrodepositors' Technical Society is being held on April 24, at 5.30 p.m., at the Northampton Polytechnic, Clerkenwell. Mr. A. W. Hothersall and Mr. C. J. Leadbeater are giving a paper on "Inspection Tests for the Adhesion of Electroplated Coatings," referring particularly to the B.N.F. Test, to be followed by the paper of Mr. B. J. Brown and Mr. H. Loyd on "A Modification of the B.N.F. Jet Test."

The annual meeting of the York Section of the **British Association of Chemists** has been arranged to take place on **April 25** at St. William's College, York, at 6.30 p.m.

The Trade Commissioner for the Union of South Africa, Mr. A. P. van der Post, is to address the **Royal Society of Arts**, John Adam Street, London, W.C.2, on **April 25**, at 1.45 p.m., on the subject of "Secondary Industries for South Africa."

A joint meeting of the **Institution of Chemical Engineers** and **Chemical Engineering Group** takes place at 2.30 p.m., on **April 25**, in the rooms of the Geological Society, Burlington House, Piccadilly. Mr. Norman Swindin, M.I.Chem.E., presents a paper on "The Treatment of Spent Pickle."

The annual general meeting of the **Food Group** of the S.C.I. will be held at 2.30 p.m. on **April 26** in the London School of Hygiene, Keppel Street, London, W.C.1, and is to be followed by an address by Mr. H. S. Sarson on "The Evolution of English Cooking."

The annual meeting of the **British Association of Chemists**, North-East Section, will be held at the County Hotel, Newcastle-on-Tyne, on **April 27** at 7 p.m.

The Manchester Section of the **Oil and Colour Chemists' Association** holds its 20th annual meeting at the Engineers' Club, Albert Square, on **April 28**, at 6.45 p.m.

The annual general meeting of the **Society of Chemical Industry**, Liverpool Section, takes place at 6 p.m. on **April 28** in Reece's Restaurant, Parker Street. Afterwards a joint meeting arranged by the Liverpool Joint Chemistry Committee is being held, when Dr. Riss, a Czech authority on the subject, will talk on "The Beet Sugar Industry."

The Extension Lectures Committee of the **University of London** has arranged a course of six lectures and discussions on "An Introduction to Industrial Management." They will be delivered at 5.30 p.m. on the following dates: **April 28**, and **May 5, 8, 12, 22 and 26**. The lecturer will be Mr. T. G. Rose, M.I.Mech.E., M.I.P.E.. The fee for the full course is 5s. and for single lectures 1s. 6d. Tickets can be obtained at the Lecture Hall, the Institution of Electrical Engineers, Savoy Place, W.C.2, or from the Accountant, University of London, the Senate House, Bloomsbury, London, W.C.1; envelopes should be marked "Extension Lectures."

The annual meeting of the **British Association of Chemists**, Notts and Derby Section, will be held on **April 29**, at 7.15 p.m., at the Midland Hotel, Derby.

The **Royal Institute of Chemistry**, Birmingham Section, meets at 11 a.m. on **April 29** to hear a lecture by Mr. R. B.

Pilcher, O.B.E., on "Chemists, 1892-1944." Members of the S.C.I., Chemical Society and B.A.C. are invited.

A conference on "Management and Society" will be held by the **Institute of Industrial Administration** from **April 28** to **April 30** at the Waldorf Hotel, London. An address on "Management and the Community" on **April 29** will be given at the conference luncheon by Sir Lynden Macassey, with Sir Francis Joseph (president of the Institute) in the chair.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Satisfactions

BRITISH SOLVENT OILS, LTD., Manchester. (M.S., 22/4/44.) Satisfaction March 30, £1000, registered July 20, 1939.

DAVEY PAXMAN & CO., LTD., engineers. (M.S., 22/4/44.) Satisfaction March 31, of debenture stock registered June 7, 1938, to the extent of £400.

EVANS SONS LESCHER AND WEBB, LTD., Liverpool, wholesale druggists. (M.S., 22/4/44.) Satisfactions March 27, £26,000, registered August 19, £14,000, £2000, £10,000, £15,000 and £6000, registered December 17, 1926, £33,500, registered July 6, 1933, £49,393, registered October 24, 1934, and £8000, etc., registered August 13, 1936.

IODRESS, LTD., London, E.C., iodine dressing manufacturers. (M.S., 22/4/44.) Satisfaction March 27, £1000 debentures registered March 30, 1943.

Company News

British Lead Mills, Ltd., announce a dividend of 10 per cent. (same) for the year ended October 31.

Imperial Chemical Industries, Ltd., announce a final ordinary dividend of 5 per cent., making 8 per cent. for 1943 (same), and a net income of £6,685,345 (£6,499,859). Forward, £1,062,018 (£965,499).

Bryant & May, Ltd., with a final dividend of 10½ per cent., are again paying a total dividend, for the year ended March 31, of 18½ per cent., tax free. Net profit for the year was £404,910 (£398,907).

Beechams Pills, Ltd., report a third interim dividend of 17 per cent. on the deferred capital, for the year ended March 31, making a total of 32 per cent. (30 per cent.) for the year.

Monsanto Chemicals, Ltd., have earned a net profit for 1943 of £92,781 (£75,748). No final ordinary dividend is being paid, as against 8½ per cent. last year, but £11,705 (nil) is allocated to staff pensions and £115,000 (nil) to income tax for the coming year.

New Companies Registered

Pure Chemicals, Ltd. (386,786).—Private company. Capital: £1000 in £1 shares. Manufacturing, consulting and research chemists, etc. Subscribers: J. Huggett, Drayton Grange, Warborough, Oxon.; T. J. L. Marfell.

Tripol Laboratories, Ltd. (386,901).—Private company. Capital: £400 in £1 shares. Manufacturers of and dealers in chemicals, oils, grease, dyes, etc. Subscribers: H. W. Fisher, Margaret E. Cricheton. Registered office: 60 Brewery Road, London, N.7.

C. R. Laboratories, Ltd. (386,704).—Private company. Capital: £500 in 200 10 per cent. non-cumulative preference and 200 6 per cent. participating preference shares of £1 each and 2000 ordinary shares of 1s. each. Manufacturers of and dealers in chemicals, fertilisers, etc. Subscribers: J. Cowles, F. W. Bailey. Solicitors: Fletcher and Co., 13 Bloomsbury Square, W.C.1.

Prebuilt Constructions, Ltd. (386,693).—Private company. Capital: £10,000 in 9500 shares of £1 each and 5000 shares of 2s. each. Manufacturers and merchants of plastics and synthetic resins, chemical products, paints, varnishes and dyestuffs, etc. Directors: H. C. B. Underdown, I. Shamah. Solicitors: Linklaters and Paines, Granite House, Cannon Street, London, E.C.4.

James Laing (London), Ltd. (386,879).—Private company. Capital: £20,000 in 19,000 preference shares of £1 each and 20,000 ordinary shares of £1 each. To acquire the business of produce importers and merchants carried on as "James Laing, Son and Co., " and to carry on the business of importers, exporters and merchants of gums, shellac, oils, waxes, chemicals, etc. Directors: A. F. Heppenstall, A. J. Kirby, W. A. Innes. Registered office: Dashwood House, 69 Old Broad Street, London, E.C.2.

Chemical and Allied Stocks and Shares

STOCK Exchange markets have remained inactive but steady, aided by the small amount of selling in evidence. The general tendency to await war developments and the forthcoming Budget again proved restraining influences to improvement in demand. Nevertheless, owing to the firmness with which they continued to be held, leading industrial shares have again been inclined to respond to any moderate buying that developed.

Imperial Chemical were under the influence of the higher profits shown by the preliminary statement for 1943, and although "ex" the final dividend, which, as expected, maintains the total payment at 8 per cent., were 38s. 3d. or within a few pence of the price current a week ago.

Turner & Newall were again favoured, and have further improved to 84s. 6d., while the units of the Distillers Co. moved higher at 90s. Moreover, there was again activity in United Molasses 6s. 8d. units which were 33s. 4½d., aided by market expectations that the dividend and bonus payments will be maintained for 1943. Wall Paper Manufacturers deferred units were higher at 39s. 3d. as were various other shares favoured on hopeful views as to prospects in the post-war period, including Barry & Staines, which rose further to 46s. Nairn & Greenwich have risen to 74s. 4½d. Iron and steel shares remained rather more active on hopeful assumptions as to the post-war outlook. Dorman Long were 27s., United Steel 25s., Stewarts & Lloyds 5s. 3d., Allied Ironfounders 50s. 4½d., and Tube Investments 96s. 6d.

Awaiting the dividend announcement, Associated Cement were 63s. British Plaster Board remained more active and moved higher at 31s. 3d. In textiles, Bleachers ordinary and preference were better on the assumption that profits are running at a better level and on market talk of the possibility that resumption of dividends on the ordinary units might be accelerated by a scheme of capital adjustment. Courtaulds eased to 52s. 3d., and British Celanese to 26s. 6d. Shares of companies associated with plastics were less active. Chief attention was again given to De La Rue, which were 17s. 3d. British Industrial Plastics 2s. shares were 6s. 7½d., and Erinoid 5s. ordinary again 11s. Elsewhere, Lewis Berger rose further to 105s. Pinchin Johnson 10s. shares remained steady at 25s. pending the full report and accounts.

In other directions, awaiting the dividends, Dunlop Rubber have again been steady around 41s., but British Match eased to 40s. 9d. Beechams Pills deferred rose to 17s. 3d. xd. under the influence of the higher dividend. At 36s. 7½d. Triplex Glass were little changed on balance. United Glass Bottle were 61s., and Forster's Glass 10s. ordinary again 31s. Borax Consolidated deferred, however, eased to 36s. Lever & Unilever kept at 35s. 6d. The yield on the latter is small based on last year's 5 per cent. dividend, but this is a case where it is assumed that after the war dividends will return to the pre-war level (10 per cent.). Imperial Smelting held their recent improvement to 14s., while British Oxygen were steady at 79s. 6d., as were British Aluminium at 47s. 4½d. An improvement to 103s. 9d. was recorded in Murex ordinary. Lawes Chemical 10s. shares changed hands at 12s. 9d. at one time. B. Laporte were 76s. 3d. "middle" and W. J. Bush 60s. Southalls (Birmingham) marked 36s. 6d., while dealings up to 20s. have been recorded in British Thermostat 5s. shares.

Fisons were 49s., and Cooper McDougall 31s. 3d. Elsewhere, Greeff-Chemicals 5s. ordinary were again 7s. 3d., and Monsanto Chemicals 5½ per cent. preference 23s. Boots Drug remained steady at 42s. 9d., while Sangers were 25s. 1½d., and Timothy Whites 33s. General Refractories 10s. ordinary showed steadiness at 15s. 7½d. xd., pending the full report and account. Gas Light & Coke ordinary were 19s. 7½d. Lead-ing oil shares were easier, but declines on balance did not exceed a few pence.

British Chemical Prices

Market Reports

FRESH inquiry in the London chemical market has been on a moderate scale and has covered a fairly wide range of materials during the past week. Trade in most sections of the market has been quiet, due to the holiday interruption, but deliveries are now being resumed on a fair scale. In the soda products section, industrial refined nitrate of soda is being absorbed in good quantities, while a fair trade has been reported in the various grades of sulphide of soda. There is no change in the position of prussiate of soda, which continues in short supply at firm prices. A steady business is being transacted in percarbonate of soda, and the hypersulphites of soda continue on a very firm basis, with good quantities being taken up. Values in Glauber salt and salt cake are well maintained and a steady inquiry is reported. The tight sup-

ply position continues in the potash section in respect of the majority of the materials, and prices remain firm. In other sections of the market, crude and refined glycerine are moving briskly at controlled levels, and buying interest in liquid chlorine is on steady lines, with the market strong. Fresh inquiry has been reported for alum lump, and formaldehyde remains a firm section. A steady trade is being done in white powdered arsenic and peroxide of hydrogen. Quiet conditions are reported in the market for coal-tar products; a steady inquiry is being made for creosote oil and cresylic acid and the light distillates are in good demand.

MANCHESTER.—The Manchester chemical market has fully recovered after the holiday break and inquiries covering a wide range of products has been on a fair scale during the past week, with caustic and other soda compounds, sulphuric and hydrochloric acids, and the magnesia and ammonia products coming in for attention. There has been a fair demand also for sulphate of alumina and alum, while borax and boric acid have been a steady trade. Prices have been well maintained throughout the range. The tar products generally, especially creosote oil and the light distillates, are moving into consumption in good quantities at the controlled levels.

GLASGOW.—In the Scottish heavy chemical trade there is no actual change to report during the past week for home business. Export trade still remains rather limited. There is also no change in the prices, these remaining very firm.

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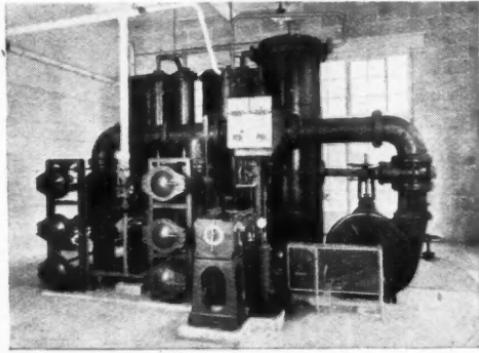
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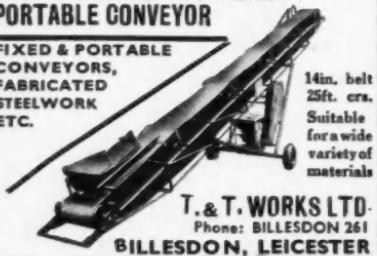
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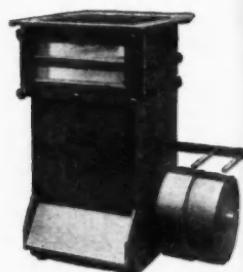
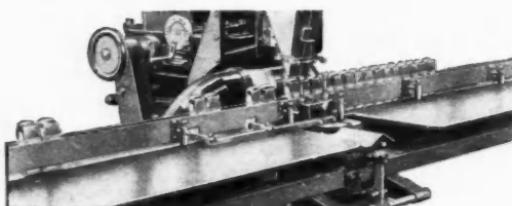
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